

**UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS**

**In cooperation with the University of Nebraska State Soil Survey
Department of Conservation and Survey Division**

**SOIL SURVEY
BUFFALO COUNTY, NEBRASKA**

BY

**F. A. HAYES, U. S. Department of Agriculture, in Charge
and A. N. HUDDLESTON and M. H. LAYTON
University of Nebraska**



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SOIL SURVEY

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SOIL SURVEY OF BUFFALO COUNTY, NEBRASKA

By F. A. HAYES, United States Department of Agriculture, in Charge, and A. N. HUDDLESTON and M. H. LAYTON, University of Nebraska

COUNTY SURVEYED

Buffalo County is in south-central Nebraska, in the third tier of counties north of the Kansas-Nebraska line. Kearney, in the south-central part, is about 125 miles west and 9 miles south of Lincoln. The county is rectangular in shape, extending 37 miles east and west and about 26 miles north and south. Platte River forms its southern boundary. The county comprises 955 square miles, or 611,200 acres.

Buffalo County lies in the loess region of Nebraska. It includes part of a broad plain underlain by loess. The surface of this plain has been considerably modified by stream erosion and wind action. Physiographically, the county may be said to include parts of two main divisions:

(1) The eroded plains which comprise the northern three-fifths and the entire upland portion, and (2) a lower flat or gently undulating and, in some places, hummocky valley known in the Nebraska surveys as the Platte Plain, which covers the rest of the county. The boundary between these two divisions is nearly a straight east-west line, except where minor stream valleys extend from the Platte Plain into the uplands. This plain crosses the southern part of the county in a general northeast-southwest direction and is about $4\frac{1}{2}$ miles north of the southern boundary in the southwestern part and about 13 miles north in the southeastern part of the county.

The eroded loess plain or upland is a remnant of an original plain which once covered the entire region. That part in Buffalo County, however, has been so modified by erosion that only the higher hill crests and broader divides approach the former level. The general surface is that of an almost level, steeply rolling, or hilly plain modified by numerous lower strips of flat alluvial lands along the larger streams. The widest and most continuous alluvial developments are along South Loup and Wood Rivers. South Loup River flows in a very meandering channel across the northern part of the county. Wood River crosses the western county line about 6 miles south of the northwest corner and flows southeastward to near Kearney in the south-central part of the county. From this point it follows a general easterly course, roughly parallel to the channel of Platte River. These streams are deeply intrenched in the plain, and their valleys separate the uplands into three major divisions, which for convenience of reference are classed as the central, southern, and northern divisions.

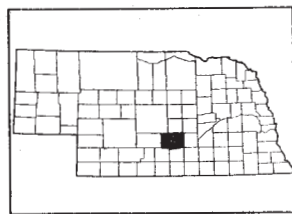


FIG. 1.—Sketch map showing location of Buffalo County, Nebr.

The central upland division is the largest. It constitutes the broad divide between South Loup and Wood Rivers and comprises about 70 per cent of the entire upland part of the county. The southern division, south of Wood River, is roughly triangular in shape, being bounded on the north and south by the alluvial lands of Wood and Platte Rivers and on the west by the county boundary. It includes about 20 per cent of the uplands. The remaining upland area, or the northern division, is a narrow elongated strip bounded by the South Loup River Valley on the south and by the county boundary on the north.

Although the surface of the three upland divisions presents a variety of features, it is predominantly hilly. The broader divides occurring between minor drainage channels are comparatively smooth.

The relief of the western and eastern parts of the central upland division, including Scott, Harrison, Schneider, Gardner, Garfield, and Cherry Creek Townships, is prevailingly gently rolling or rolling. Most of the hills are well rounded and the intervening valleys, though many are deep, are generally broad and have gradual slopes.

In Logan, Armada, and part of Elm Creek Townships in the southern upland division, the surface of the loessial deposit has been carved into a network of deep, steep-sided ravines and narrow valleys separated by sharp crestlike divides and ridges. Erosion is excessive, and most of the land is too rough for profitable farming. In many places the shelflike appearance of the slopes shows the effect of small landslides. Similar relief exists in parts of the northern upland division and in the extreme western part of the central division.

The alluvial land, which includes the terraces and flood plains, covers about two-fifths of Buffalo County. The largest area is a part of the broad Platte Plain previously mentioned. This area extends in a general east-west direction across the southern part of the county and lies between Platte River and the southern edge of the eroded plains or uplands. It is roughly triangular in shape, being about 14 miles wide along the eastern county boundary and tapering to less than 5 miles where the uplands are near the river in the extreme southwestern part. Narrow continuous strips of alluvial lands varying in width from a quarter of a mile to about 2 miles also occur throughout the uplands, as along South Loup and Wood Rivers and their larger tributaries.

The alluvial lands are flat or gently undulating, and their surface is modified in places by shallow stream channels, depressed areas, and old cut-offs. In a few places, however, the surface of the broad Platte Plain has a choppy or hummocky relief where wind action has been especially severe.

The terraces or second bottoms constitute about 75 per cent of the alluvial lands. They are underlain by material deposited when the streams were flowing at higher levels. Subsequent intrenchment has left these deposits at different elevations depending on the depth to which the streams had cut when the deposits were made. The older benches have either been entirely removed or have lost their identity through erosion. The highest remnant is about 4 miles west of Ravenna on the south side of Muddy Creek. Its surface is from 50 to 60 feet above the stream channel. The remaining terraces

are from 15 to 25 feet above the streams and from 75 to 125 feet below the general upland level. The transition between the terraces and upland is marked in most places by a steep slope, but on the south side of South Loup River, in the northeastern part of the county, wind action has modified the normal gradient.

The bottom lands or flood plains occupy the lowest positions in the county and are most typically developed along Platte River, where they occur as a broad band extending across the southern part of the county in an east-west direction. Narrow linear areas border the channels of South Loup and Wood Rivers.

Buffalo County has an average elevation of about 2,150 feet above sea level. It ranges from approximately 1,930 feet, where South Loup River crosses the eastern boundary, to about 2,500 feet in the northwestern part of the county. This gives a range of about 570 feet between the lowest and highest points. The average elevation of the eroded loess plains or uplands is about 2,200 feet above sea level. The northern upland division has the lowest average elevation, about 2,100 feet, and the southern division has the highest elevation, approximately 2,350 feet. The average elevation of Platte Plain is about 2,100 feet above sea level. The general slope of the county is to the east.

Well water of excellent quality is readily obtained in all parts of the county. In the uplands the supply is usually obtained from the sand layer underlying the loess and wells range in depth from 60 to 150 feet. Wells are shallower on the floors of drainage ways or where the loessial mantle has been greatly thinned by erosion. Throughout Platte Plain and the alluvial lands along South Loup and Wood Rivers the water table is near the surface and the wells range in depth from 10 to 40 feet. The underground water throughout the lowlands is mostly seepage from higher levels or from the stream channels, but is usually of excellent quality.

Narrow belts of forest border all the larger streams. The growth along Platte and South Loup Rivers is predominately cottonwood and willow. In the upper courses of Wood River, however, there is considerable ash, elm, and box elder, interspersed with some oak and hackberry. The trees are of value only for firewood and fence posts. The forest growth seldom extends far from the stream channels and the greater part of the county is practically devoid of tree growth except for small groves of cottonwood, ash, and box elder which have been planted on many farms.

The boundaries of Buffalo County were established by the second Territorial Legislature of Nebraska in 1855. At that time the county included parts of the present Hall and Dawson Counties. Later legislation gave the county its present boundaries. The first settlement was made in 1858. The early settlers were of many nationalities, but a large proportion were American born. The county was organized in 1870.

According to the 1920 census, the population of Buffalo County is 23,787 of which 32.4 per cent is classed as urban. The density of the rural population is given as 17 persons to the square mile. The rural population is rather evenly distributed, although it is somewhat denser throughout the better-drained alluvial lands and the flatter areas of the loessial uplands.

Kearney, the county seat, is in the south-central part of the county and has 7,702 inhabitants. It comprises the entire urban population. The city is an important educational, railroad, and distributing center and furnishes a good market for much of the surplus grain, dairy, and poultry products.

Ravenna, in the northeastern part of the county, ranks second in population with 1,703 inhabitants; Shelton, in the southeastern part, is the oldest town and has a population of 1,037. The population of Gibbon is 883; of Elm Creek, 600; of Pleasanton, 262; of Amherst, 259; of Miller, 223; and of Poole, 105. Nantasket, Sweetwater, Saint Michael, Optic, Buda, Glenwood Park, Riverdale, Watertown, Denman, and Odessa are small villages and railroad points.

The southern, western, and northeastern parts of the county have good railroad facilities. A main line of the Union Pacific Railroad, a main line of the Chicago, Burlington & Quincy Railroad, and branches of these railroads pass through many towns in the county.

Buffalo County is well supplied with public roads. The Lincoln Highway traverses the southern part from east to west, and State highways extend north and south across the central part and cross the northeastern part. Most of the public roads, including the State highways, are on land lines, except in the rougher sections where they follow ravines and ridges on account of the cheaper construction and maintenance expense. The Lincoln Highway, a State and a Federal road, parallels the Union Pacific Railroad and follows land lines only part of the way across the county. All roads are of dirt except the Lincoln Highway which has recently been surfaced with gravel. The more important roads, including the State and Federal highways and the roads between towns, are well graded and kept in good repair throughout the year. The minor roads are neglected in many places and are sometimes impassable. Bridges span Platte River south of Elm Creek, Kearney, and Gibbon. The construction of concrete culverts and steel bridges even on minor roads is receiving increased attention.

Rural mail delivery reaches all parts of the county, and telephones are in common use.

Most of the surplus agricultural products are shipped to Omaha or Lincoln. The surplus wheat and corn are usually hauled to local elevators, where they are either sold or stored until the market is favorable.

CLIMATE

The climate of Buffalo County is typical of west-central Nebraska and is well suited to grain farming and livestock raising. The winters are fairly long and the summers rather warm. Spring usually is cool, with considerable precipitation. The fall season is long, with moderate temperatures and occasional periods of rainy weather. The rainfall is moderate, the humidity relatively low, and the rate of evaporation rather high. Differences in surface relief are not sufficient to cause appreciable differences in climate within the county.

The mean annual precipitation is 25.12 inches. The precipitation for November, December, January, and February is less than an inch each month. The rainfall is heaviest during May, June, July,

and August, when most of the rainfall occurs during local thunderstorms. The rainfall in May and June is usually well distributed, and periods of drought are uncommon. In July the distribution is less favorable, and during August and September periods of drought sometimes cause reduced yields of grains. Total crop failures, however, are very rare even in the poorer section of the county, as most of the soils, when properly managed, retain sufficient moisture for crops. The precipitation in the wettest year on record (1881) was 37.72 inches, of which 19.46 inches fell during May, June, and July. In the driest year (1894) the precipitation was only 15.66 inches. The average annual snowfall is 31.5 inches.

The mean annual temperature is 49.6° F. The mean for the summer months is 72.2°. July is the warmest month with a mean of 74° and January the coldest with a mean of 24.2°. The average date of the last killing frost is May 6, and that of the first is October 2. This gives an average frost-free season of 148 days, which is ample for the maturing of all crops commonly grown. Killing frosts have been recorded as late as May 27 and as early as September 12.

During most of the year the prevailing winds are from the south, but in December, January, and February the winds are mainly from the northwest. Strong winds are common but tornadoes are rare. The proportion of clear and sunshiny days is comparatively high.

The following table gives the normal monthly, seasonal, and annual temperature and precipitation at Ravenna in the northeastern part of the county and may be taken as fairly typical of the county as a whole.

Normal monthly, seasonal, and annual temperature and precipitation at Ravenna

[Elevation, 2,028 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1894)	Total amount for the wettest year (1881)	Snow, average depth
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December.....	27.5	76	-25	0.74	0.51	0.17	4.9
January.....	24.2	72	-38	.60	.73	.98	5.4
February.....	25.1	77	-36	.83	.52	2.22	7.6
Winter.....	25.6	77	-38	2.17	1.76	3.37	17.9
March.....	36.8	91	-13	1.15	.81	1.75	7.7
April.....	50.0	98	11	2.72	1.97	2.13	1.9
May.....	59.3	100	20	3.55	.99	7.32	.4
Spring.....	48.7	100	-13	7.42	3.77	11.20	10.0
June.....	69.4	104	35	3.87	3.28	6.00	.0
July.....	74.0	107	38	3.94	1.38	6.14	.0
August.....	73.1	106	36	3.14	1.49	1.27	.0
Summer.....	72.2	107	35	10.95	6.15	13.41	.0
September.....	65.1	104	20	2.18	1.37	5.10	Trace.
October.....	52.2	93	4	1.66	2.49	3.76	.9
November.....	38.0	83	-30	.74	.12	.88	2.7
Fall.....	51.8	104	-30	4.58	3.98	9.74	3.6
Year.....	49.6	107	-38	25.12	15.66	37.72	31.5

AGRICULTURE

The area now included in Buffalo County was originally covered with a luxuriant growth of prairie grasses, with marginal strips of forest along the larger streams. In the early part of the decade between 1850 and 1860 cattlemen were the chief inhabitants. They practiced cattle raising exclusively, pasturing the open range where the great variety of nutritious grasses afforded good grazing. Winter losses were often very heavy, as the stock had little protection, but the range was free and the profits on the animals that survived were large. The old Oregon Trail to the gold fields in the West followed the north side of Platte River, and the cattlemen did not lack outside communication.

The first people to realize the agricultural possibilities of the county were a party of Mormons who in 1853 located along the Oregon Trail near the present site of Shelton. Later, settlement gradually spread throughout the Platte River Valley and the uplands, and the cattlemen were forced to move farther west. Sod corn and garden vegetables were usually the first crops planted, as these commodities were readily sold or traded to emigrants along the Oregon Trail. As conditions became more stable and settlement more permanent, the farmers began to break land for the extensive production of corn, wheat, oats, barley, and rye.

The early development of agriculture was slow, owing to the lack of markets and transportation facilities and to the ravages of insect pests. In 1874, 1875, and 1876 grasshoppers destroyed crops over large areas. For a few years after 1890 severe droughts caused total failures in many localities. The early settlers had little capital to tide them over disastrous years and, as a result, were slow in recovering.

The census reports the average value to each farm of all farm property, including land, buildings, implements, and domestic animals, as \$1,781 in 1880; \$4,932 in 1890; \$5,465 in 1900; \$15,453 in 1910; and \$27,963 in 1920. Between 1880 and 1920 the number of farms increased from 1,235 to 2,376.

Acreage and production of principal crops in 1889, 1899, 1909, and 1919

Crop	1889		1899		1909		1919	
	<i>Acres</i>	<i>Bushels</i>	<i>Acres</i>	<i>Bushels</i>	<i>Acres</i>	<i>Bushels</i>	<i>Acres</i>	<i>Bushels</i>
Corn.....	103,221	4,133,360	155,285	3,768,810	161,091	2,981,603	157,195	4,433,284
Wheat.....	26,575	359,176	62,979	431,250	61,890	1,084,737	86,329	926,929
Oats.....	40,565	1,140,725	49,611	1,049,400	47,095	762,369	23,359	581,716
Barley.....	1,202	25,526	1,632	19,230	242	3,782	6,956	140,126
Rye.....	673	10,076	5,349	47,640	382	4,265	5,148	56,060
Emmer and spelt.....					50	1,188		
Buckwheat.....	201	1,727	6	60	2	30		
Potatoes.....	2,285	199,938	1,837	174,015	1,490	74,198	1,716	84,152
	<i>Tons</i>		<i>Tons</i>		<i>Tons</i>		<i>Tons</i>	
Timothy and clover.....					43	58	87	156
Millet and Hungarian grass.....			2,194	3,732	1,033	1,215		
Alfalfa.....			7,444	17,486	37,634	73,387	31,704	59,672
Other cultivated grass.....			166	242	910	1,146	3,709	5,851
Wild hay.....	45,799	58,976	35,582	36,873	38,191	38,190	38,145	36,324
Coarse forage.....			1,490	3,583	4,092	6,103	11,573	29,075
	<i>Trees</i>	<i>Bushels</i>	<i>Trees</i>	<i>Bushels</i>	<i>Trees</i>	<i>Bushels</i>	<i>Trees</i>	<i>Bushels</i>
Apples.....	8,004	2,401	42,355	5,170	24,040	27,752	13,777	6,536
Cherries.....					7,064	491	9,677	5,470
Peaches and nectarines.....	415	16	10,975	29	12,635	382	648	67

The preceding table, compiled from the census reports, gives the acreage and production of the principal crops of the county in 1889, 1899, 1909, and 1919 and shows the general trend of agriculture since 1889.

The present agriculture of Buffalo County consists of diversified farming, including the production of grain and hay and the raising of livestock. According to the last census report, the principal farm crops are corn, wheat, wild hay, alfalfa, oats, coarse forage, barley, and rye, ranking in acreage in the order named.

The type of farming practiced is uniform throughout the county except that the comparative importance of the various crops differs with the section. The proportion of land used for grazing is larger throughout the bottom lands and the more sandy and rougher parts of the uplands than elsewhere. A larger proportion of the better-drained terrace land is used for alfalfa on account of the favorable moisture supply and usual high yield.

The Federal census reports the value of all crops produced in Buffalo County to be \$11,077,544 in 1919. The value of dairy products was \$404,647 and of poultry and eggs was \$503,562. The total value of all domestic animals on farms in the county in January, 1920, was \$5,598,147.

Corn is by far the most important crop, and on farms where it is not fed to livestock it is the chief cash crop. In 1919 it was grown on 157,195 acres, or a larger area than that devoted to oats, wheat, rye, barley, and alfalfa combined. The total yield was 4,433,284 bushels, or an average of about 28 bushels to the acre. This yield is greatly exceeded on the heavier-textured terrace lands and on the flat or gently rolling parts of the loessial uplands where from 35 to 45 bushels to the acre are commonly obtained. Corn is grown to a greater or less extent on all soils of the county but most extensively on the Holdredge soils of the uplands and on the Hall and Waukesha soils of the terraces. On farms operated by owners, most of the corn is fed to hogs, beef cattle, and work animals, but on tenant farms more of the crop is sold. Practically all the corn is of the dent varieties, though little attention is given to keeping the strains pure. Reid Yellow Dent and Iowa Silvermine are probably the varieties most extensively grown.

The common practice is to husk the corn from the standing stalks in the fall and pasture cattle and horses in the field during the winter. A part of the crop is cut for winter roughage. On farms equipped with silos, from 15 to 20 acres of corn are cut each year for silage. This corn is usually cut with a corn binder when the ears are in the dough stage and is hauled to the silage cutter while the stalks are green. Many farmers annually fence off a few acres of unhusked corn for hog range, and a few fatten cattle in the fields, thereby saving the expense of husking the crop. Many tenant farmers grow corn on the same land for several consecutive years. Better yields are obtained, however, if the crop is rotated with small grains and alfalfa. In recent years considerable attention has been given to the selection of seed corn, but seed selection is not generally practiced.

Wheat ranks second to corn in acreage, the ratio being approximately two acres of corn to one of wheat. The Federal census reports 86,329 acres in wheat in 1919, with a total yield of 926,929

bushels, or an average of about 11 bushels to the acre. Winter wheat is grown practically to the exclusion of spring wheat. It can be sown in the fall at a time when farm work is light, and it usually matures before dry weather and hot winds occur. The yield fluctuates less than that of spring wheat. Turkey is the principal variety, though considerable Kanred has been grown during recent years. The latter strain is very hardy and is not seriously affected by smut and rust which occasionally damage Turkey wheat. During average years the returns from Kanred are slightly larger than from Turkey, but in unfavorable years the yield of Turkey is decidedly greater. The strains are kept pure by the more progressive farmers, but on many tenant farms they have become mixed. Wheat is planted on the heavier-textured terrace and upland soils of the county. It is a hard-land crop and is seldom grown on the more sandy soils because the loose incoherent seed bed favors soil drifting and consequent injury to the shallow roots. The crop is usually cut with a binder. In exceptionally dry seasons when the stems are too short for binding, the grain is headed. The crop is shocked or stacked in the field for threshing. Most of the grain is sold direct from the threshing machine, but a few farmers store their grain for a higher market. Considerable wheat is sold to the flour mills at Kearney, Gibbon, and Ravenna.

The area devoted to oats is about one-fourth that used for wheat. According to the 1920 census, there were 23,359 acres in oats in 1919. The total yield was 581,716 bushels, or about 25 bushels to the acre. Kherson is the leading variety. The acreage in oats has decreased materially during the last few years, principally because of the larger returns obtained from wheat and corn. At present, most of the oats are grown as a step in the rotation between corn and wheat or alfalfa. Very little effort is made to control smut, although the disease sometimes reduces yields as much as 16 per cent in wet seasons. The crop is usually cut with a binder and either shocked or stacked for threshing. Most of the grain is used as feed for work animals. The straw, which has a rather high feeding value, is usually left in the field where livestock are given access to the stacks, and but little of the straw is baled. Some farmers procure their seed from other sections, but most of them simply clean a sufficient quantity of the previous crop for seed. Oats are grown on all but the sandier, rougher, and more poorly drained soils of the county. The largest yields are obtained on the more nearly level uplands and the heavier-textured soils of the terraces.

Barley was grown on 6,956 acres in 1919 and yielded 140,126 bushels, or an average of about 20 bushels to the acre. This crop is grown for feed on the terraces, uplands, and first bottoms. It does very well on the moist but not wet bottom-land soils. The crop is cut with a binder and later threshed. The grain is usually fed to hogs. The straw remains in the field as left by the thresher, and the livestock are allowed to feed on the stacks.

Among the grain crops, rye ranks next to barley in acreage. In 1919 the 5,148 acres of rye grown yielded 56,060 bushels, or an average of about 11 bushels to the acre. The crop is grown chiefly on the heavier upland and terrace soils but does fairly well on the sandy bench lands. Though generally raised for grain, it is grown

to some extent for hay and pasture. It is more drought resistant than wheat and flourishes on more impoverished soils. In cutting the crop, either a binder or header is used, depending on the length of the straw. The grain is threshed from the shocks or stacks, the latter method being used when the grain is headed. Most of the rye is fed to livestock on the farms where it is produced. Many farmers plant a small patch of rye for pasture early in the fall.

The hay crop has been of considerable importance since the county was settled. Wild hay still occupies the leading acreage, but the area devoted to this crop has gradually decreased with the increase in grain and alfalfa production. The 1920 census reports that in 1919 the 38,145 acres in virgin hay land in Buffalo County yielded 36,324 tons. The principal hay grasses throughout the loessial uplands and on the heavier-textured terrace soils are grama and buffalo grasses, together with considerable bluestem. Throughout the areas of sandy upland soils and those of the coarser-textured terraces, sand grass, stipa or needle grass, and bluestem predominate. Considerable marsh and swamp grass occur throughout the bottom lands along Platte River.

Buffalo, grama, and bluestem grasses afford the best pasturage. When they are cut for hay the yield is from one-half to three-fourths ton to the acre, depending on the rainfall. The sand grasses are usually rather sparse, though they have high feeding value. From 3 to 4 acres are required to produce a ton of hay in normal years. Bottom-land grasses yield the highest, from 1 to 1¼ tons of hay to the acre being commonly obtained. The hay, however, is coarse, is less nutritious, and has a lower market value than that obtained from the better-drained soils of the county.

In 1919 alfalfa was grown on 31,704 acres, or almost as large an area as that devoted to oats, rye, and barley combined. The total yield was 59,672 tons, or almost 2 tons to the acre. The acreage decreased considerably during the World War on account of the higher returns obtained from grain crops. In the last few years, however, alfalfa has been planted more extensively on account of its high feeding value. It is grown on all soils of the county except dunesand, the more sandy members of the Valentine series, and the poorly drained bottom lands. The highest yields are obtained on the heavier-textured terrace lands. Three cuttings, and in exceptional seasons four, are obtained. Most of the alfalfa is fed to cattle, horses, and hogs on the farms where it is produced, although some is annually baled and shipped to outside markets. Many farmers run hogs in the alfalfa fields during the summer, but cattle are seldom allowed to graze on green alfalfa on account of the danger of bloating.

Coarse forage crops, including corn, kafir, and grain sorghums, were grown on 11,573 acres in 1919. The total yield was 29,075 tons, or about 2½ tons to the acre. Sorghum does well, yielding from 2½ to 4 tons of fodder to the acre and about 20 bushels of seed. The fodder is usually fed to cattle and horses. Kafir ordinarily yields about the same as sorghum. It makes excellent feed for work animals and cattle.

Among the minor crops, millet, clover, potatoes, and garden vegetables are grown on small patches for feed or for home consumption. The raising of truck crops, including tomatoes, cucumbers,

cantaloupes, watermelons, celery, and onions, is practiced in the Platte River Valley south of Kearney. Accurate data on the crop yields, however, are not available as the truck-farming industry is new and records have not been kept.

Not much attention is given to fruit production. There are no large commercial orchards in the county, although most farms have small orchards of apple, plum, and cherry trees to supply fruit for home use. Orchards, in general, are in poor condition. Little attention is given to their care, and many trees have died during recent years. Some grapes, strawberries, blackberries, and raspberries are produced. Among the wild fruits, grapes, plums, and chokecherries are fairly abundant during favorable seasons. Practically all the fruit is consumed locally, and considerable quantities are shipped into the county.

The value of livestock and livestock products in Buffalo County is considerably less than that of farm crops, but the revenue derived from the livestock industry forms an important source of farm income. Much of the county is used as grazing land, and the raising of beef cattle is very important. The Federal census reports 48,667 cattle, valued at \$2,495,355, in the county in 1920. Of these, 38,472 were beef animals. There are only a few purebred herds, though many purebred bulls have been introduced in recent years to improve the grade stock. The quality of beef cattle in general is very good. Hereford and Shorthorn are the principal breeds, although there are a few herds of Aberdeen Angus. There is considerable pasture land in the county, and many farmers purchase livestock for summer grazing. Most of the cattle are sold as feeders or stockers after coming off summer range, though large numbers are fattened on corn before they are shipped to outside markets. A few farmers annually ship in cattle for winter feeding.

Dairying receives little attention. There are a few purebred dairy herds, chiefly of the Holstein breed, in the county, but the dairy industry consists chiefly of the sale of surplus cream and butter. From six to eight milk cows, chiefly of the beef breeds, are kept on the average farm. Most farmers have cream separators. The surplus dairy products are sold in the near-by towns, from which part of the cream is later shipped to Fremont, Lincoln, or Omaha.

Hog raising is practiced extensively. The 1920 Federal census reports 60,396 hogs, with a total value of \$1,154,477, in Buffalo County. Most of the hogs are raised on the heavier terrace and upland soils where there is an abundance of corn and alfalfa. Hog raising is of minor importance on the sandier soils, as these areas are more suitable for grazing than for grain production. All the hogs are of good breeds, chiefly Duroc-Jersey, Poland China, and Hampshire, and there are several purebred herds in the county. The hogs are fattened on corn, either in feeding yards or by turning them into the fields to "hog down" the corn in the fall. Alfalfa is usually added to the ration, and in summer the pigs are often allowed to run in the alfalfa fields until the third crop is ready to cut. In past years heavy losses have been caused by hog cholera. Attention is now given to vaccination and sanitation, and losses have been greatly reduced in recent years.

Horses are raised on nearly every farm. Many ranchers in the more sandy or rougher parts of the uplands have larger herds than are usual on account of the prevailing low prices and poor market for horses during recent years. Most of the horses have been improved from the western broncho, through the use of purebred Percheron or Belgian sires. The animals in use at present are of medium-weight draft type, ranging in weight from 1,100 to 1,400 pounds. Many mules are raised, especially throughout the Platte River Valley in the southern part of the county. According to the census there were 18,533 horses, with a value of \$1,474,589, and 1,597 mules, valued at \$160,341, in the county in 1920.

Sheep raising does not receive much attention, although many farmers annually ship in a carload or two of sheep to fatten on corn and alfalfa. A few small flocks are grazed in the rougher parts of the county. The census reports 29,087 sheep, valued at \$310,123, in the county in 1920.

Poultry is raised on all farms and constitutes an important source of farm income. There is a good local demand for poultry products and in general more attention is given to the industry than formerly, but there are no specialized poultry farms. Plymouth Rock, Leghorn, Rhode Island Red, and Orpington are the leading breeds. Many farmers also raise a few geese, ducks, turkeys, and guinea fowls. The 1920 census reports 222,557 chickens and 5,924 other poultry in the county.

The adaptation of certain soils to particular crops, as well as the influence of surface relief and drainage on crops, is observed by most farmers. Excessive drainage in parts of the upland and poor drainage in some bottom-land areas have hindered development of farming on some soils. Certain positions on slopes or hills, where crops are less likely to suffer from winds and frosts and where there is sufficient moisture, are probably well adapted for orchards and trees. Farmers realize that the flat or gently rolling "hard-land" soils of the uplands and terraces are well adapted to all crops common to the region. The more stable sandy soils produce good yields of rye, corn, and potatoes but are not so well adapted to wheat, oats, and alfalfa. The sandy, shifting dunesand makes farming unprofitable on it, and the land is devoted to grazing. No farming is done on the rougher eroded slopes of the Colby soils, and profits are possible only when large tracts are used for grazing. The wet bottom lands are used for pasture and hay production. Alfalfa does exceptionally well on the lower terraces where the subsoil is rich in lime and moisture conditions are especially favorable.

No definite system of crop rotation is practiced in Buffalo County. Most farmers have more or less indefinite systems, subject to numerous substitutions. Corn is usually followed by oats and oats by wheat or alfalfa. When alfalfa sod is broken the land is, in many instances, used for corn for 2 years, oats for 1 year, wheat for 1 or 2 years, and is then returned to corn. Many farmers raise corn on the same land for 4 or 6 years, and follow it by oats for 1 year and by wheat for 1, 2, or 3 years. A rotation which is popular is corn, 2 years; oats, rye, or barley, 1 year; wheat, 1 or 2 years; and alfalfa, from 4 to 6 years.

Considerable attention is given to the preparation of the seed bed and the subsequent care of crops. In the more sandy sections corn is usually listed in, as the ridges tend to prevent soil blowing. Throughout the loessial uplands and terraces much of the corn is planted in checkrows. This method requires more careful seed-bed preparation and is conducive to higher yields. On the more rolling land, listed corn is subjected to severe washing in seasons of heavy rainfall, and on the steeper slopes entire rows are sometimes washed out.

The preparation of the seed bed for small grain varies somewhat according to the soil. The heavier-textured soils are plowed from 4 to 6 inches deep and are thoroughly disked before planting. The more sandy soils are plowed only every second or third year, and during intervening years the land is prepared by double disking. All small grain is planted with a press drill. On many tenant farms even the heavier-textured soils are plowed only every second or third year, but the land is thoroughly disked before planting. Some farmers sow wheat between the corn rows in the fall.

Alfalfa requires a smooth, mellow seed bed and is usually planted on thoroughly plowed, disked, and harrowed wheatland. It is usually sown broadcast and harrowed in, although a few farmers prefer to plant the seed with a press drill. A stand is easily obtained, except on the sandier soils which are low in lime. Alfalfa sod is seldom broken until after the fourth or fifth year or until the stand is no longer profitable.

As a rule farms are well improved and have a general appearance of prosperity. Most of the houses and barns are painted and kept in good repair. Farms are fenced and cross fenced, usually with barbed wire. Most feed lots and many alfalfa fields are inclosed with hog-tight woven-wire fencing. The ranches in the rougher and more sandy parts of the county are seldom cross fenced, as the land is suitable only for grazing. Modern labor-saving implements are in general use. Most farms are equipped with grain drills, mowers, rakes, binders, riding cultivators, and disk harrows. A few farmers have corn binders and hay balers. Tractors are operated on a few of the more level areas, but are not in common use throughout the county. There are enough threshing machines to handle the grain crops. Most of these are owned by farmers who thresh the grain in the surrounding community. The more expensive farm machinery is kept under shelter.

Commercial fertilizer is not used in Buffalo County. Barnyard manure, when available, is applied to the land, but the supply is usually insufficient to have much effect on crop yields. Most of the manure is piled on the ground out of doors where much of its fertilizing value is lost by leaching. It is usually hauled in fall or spring and spread on land to be used for corn or small grain. On rented land little care is used in applying manure where it is most needed, and it is usually spread on land adjacent to the barnyard. The need of fertilizer may not be general in Buffalo County, as the land is new and in no immediate danger of becoming exhausted.

Most farm work is done by the farmers and their families, as labor is scarce, especially during the harvest season. Most of the hired laborers are natives. A few farmers hire help by the year in order

to insure against lack of labor at critical periods. Wages range from \$30 to \$45 a month with board and room. Day laborers receive from \$1.75 to \$2.25. Corn shuckers receive 4 or 5 cents a bushel.

The Federal census reports that 94.4 per cent of the county was included in 2,376 farms in 1920. The average size of the farms was 240.3 acres, of which 182.4 acres, or 75.9 per cent, were improved. Most of the farms range in size from 100 to 320 acres, although there are many small holdings and several large ranches of more than 1,000 acres.

In the last 40 years the proportion of farms operated by owners has greatly decreased. In 1880, 91.6 per cent of the total and in 1920 only 49.2 per cent were operated by owners. In 1920, 1,170 farms were operated by owners, 1,178 by tenants, and 28 by managers.

The share rental system predominates in Buffalo County. Under this system the tenant furnishes all equipment, labor, and seed and receives from two-fifths to one-half the crops. Farms suited only for pasture are commonly rented for a lump sum, depending on the grazing value of the land. On many farms the renter is allowed to use the pasture land without charge.

The 1920 census reports the average assessed value of all the land in farms in Buffalo County to be \$90.03 an acre. The selling price of land ranges from about \$20 to \$200 an acre, depending on the soil, position and surface relief, drainage, improvement, and location with respect to markets. The highest-priced land, regardless of quality, is in the immediate vicinity of the larger towns. The lowest price applies to areas of dunesand and severely eroded and gullied areas of the Colby soils. The average price of farm land throughout the uplands is about \$100 an acre. Areas of the heavier-textured terrace soils sell for about \$125 an acre and the bottom land for prices ranging from \$40 to \$200, depending on location, drainage, and improvements.

SOILS

Buffalo County lies in that part of the Great Plains where the rainfall is moderate. The mature soils of the region have not been leached of their carbonates and other easily soluble compounds to a depth greater than 3 feet. The county is also in the prairie region of the United States, where the surface features and climate have favored the growth of a luxuriant grass vegetation. The soils, therefore, except those on the severely eroded valley slopes, on the wind-laid sands, and on the most recent alluvial deposits, all of which are immature, show the influence of grass vegetation and of weathering under the prevailing climatic conditions.

The most striking characteristic of most of the soils of the county is the dark color of their surface layers. This color results from the presence of organic matter or finely divided carbonaceous material, derived mainly from the partly decayed grass roots and intimately mixed with the mineral part of the soil, and varies with the quantity of organic matter contained. Soils are usually darkest on the flatter areas and in depressions where an abundance of moisture has especially favored the growth and decay of vegetation and the position has prevented the removal of the organic material through erosion. On the steeper valley slopes, throughout areas of loose or

incoherent sand, and on the most recent alluvial deposits vegetation is sparse, and the parent soil materials have not accumulated enough organic matter to darken their surfaces. Lighter-colored soils have developed in such areas. Therefore, in Buffalo County the soils range in color from black to gray or almost white, depending on their content of organic matter.

The second characteristic common to most of the soils of the county is the arrangement and character of the different layers. This will be discussed later.

The two principal characteristics mentioned have been imparted to the soils by the various weathering processes including leaching, oxidation, and the accumulation of organic matter. These processes, however, have been more or less influenced by the composition and mode of accumulation of the materials from which the soils have weathered. On the basis of parent materials the soils of Buffalo County are divided into three groups—loessial, aeolian, and alluvial.

A silty deposit, identified by the geologists of Nebraska as loess, once covered the entire county as a smooth, thick mantle. It was later eroded and in places entirely removed by stream action. In its unweathered condition, the loess is uniform in texture and is composed largely of silt particles. It varies in color from brownish yellow to yellow or almost white and is characterized, where not highly weathered, by a tendency to split vertically, producing perpendicular bluffs along watercourses, roads, and in other places subject to erosion. Lime is abundant, and a small quantity of iron stains the material in many places.

Since its deposition most of the loessial deposit throughout Buffalo County has undergone marked changes by weathering and by the accumulation of organic matter. The surface of the deposit, through the accumulation and decomposition of organic matter, has become dark brown or almost black over large areas. It is dark and deep on the smooth level areas which especially favor vegetative accumulation and decay. The color is naturally darkest in depressed areas on the flatter divides and is lightest in areas of steep slopes where the run-off is great and erosion is active. The flat and depressed areas are also characterized by a layer of material, heavier and more compact than typical, which occurs between depths of 2 and 4 feet. This compact layer is probably formed by the downward leaching and concentration of the fine surface particles, through the agency of percolating water. Those soils which have a dark surface layer are grouped in the Holdredge and Scott series. The Holdredge soils have weathered under normal drainage conditions and have friable subsoils except in the flat phase of the silt loam which has a slightly compact subsoil zone caused by restricted surface drainage. The Scott soils occur only in depressions and are poorly drained. The severely dissected parts of the loessial mantle throughout which erosion has prevented the accumulation of much organic matter on the surface are classed in the Colby series.

A sand sheet underlies the loess mantle of Buffalo County. It has been exposed over a considerable area in the northeastern part of the county and in spots throughout the South Loup River Valley where the protective loess covering has been removed by erosion. The material, however, has been so mixed with wind-blown sand from the

South Loup River channel and from the bottom lands and terraces along that stream and has been so shifted about and reassorted by the wind, that it is not possible to make any definite statement as to its origin. In its unweathered condition the material is loose, incoherent sand, composed largely of quartz. It varies in color from light brown to yellowish gray. The soils which have weathered on this sandy material have been grouped with soils derived from wind-blown materials. Where the wind has been most active the sand has been heaped into dunes varying in height from 30 to 100 feet, and the areas are classed as dunesand. Where the relief is less pronounced and wind erosion is negligible, the sandy material is classed with the Valentine series.

In addition to producing dunesand and the Valentine soils, the wind-blown sandy deposits have greatly modified the physical characteristics of the adjoining loessial uplands and of the lower alluvial lands.

The alluvial materials of Buffalo County have been transported by streams and deposited in their present position as sediment. Obviously, therefore, the character of the alluvial deposits depends largely on their origin and on the depth to which the streams had cut at the time of their deposition. The smaller upland streams flowing through areas of loess carried only fine-textured silty material and their sediments were naturally uniform and silty. The same is true of Platte and South Loup Rivers in the early stages of their development, as is shown by the uniformly fine texture of the older terrace remnants along them. Subsequent intrenchment of Platte and South Loup Rivers into the sand sheet which underlies the loess gave rise to coarse sandy sediment. The mixing and reassorting of the fine and coarse particles has produced materials ranging in texture from clay to coarse sand and gravel. Where these materials occur on well-drained terraces they have weathered into soils classed in the Waukesha, Hall, O'Neill, and Sparta series, and where they are on first bottoms and are subject to overflow they have been grouped in the Cass, Lamoure, Wabash, and Sarpy series. The Waukesha, Hall, Lamoure, and Wabash soils have weathered from fine-textured silty sediments and the O'Neill, Sparta, Cass, and Sarpy soils from coarse, sandy materials.

Each soil series previously enumerated includes a group of soils which are similar in color, structure, and other characteristics and in the source, character, and process of accumulation of the material from which they have developed. The soils within each series are differentiated into types on the basis of the texture of the surface material. Twenty-seven types of soils, representing 12 series, and 2 miscellaneous classes of land, riverwash and dunesand, have been mapped in the county.

UPLAND SOILS

Well-developed soils.—The upland soils of the county are predominantly those of the Holdredge series. They have developed from loess. From place to place, the profile of the Holdredge soils varies slightly in the thickness of the various layers. However, the number and the physical character of the layers are the same. The features common to these profiles, evident in the succession of layers from the surface downward, are as follows:

(1) A surface layer of very dark grayish-brown, very friable material composed of a loose mixture of mineral soil particles and organic matter about 6 inches thick. In uncultivated areas, a well-defined horizontal splitting of the soil into thin laminæ is often noticeable in the lower 2 or 3 inches of the layer, though this splitting may be obscured by grass roots. The organic matter which gives the layer its dark color is thoroughly mixed with the mineral constituents and there is practically no color change when the soil material is crushed.

(2) In the second layer, which extends to a depth of about 18 inches, the soil particles are for the most part grouped into small subangular or almost round granules varying from about the size of a pinhead to slightly more than one-half inch in diameter. The larger particles are most abundant in the lower part of the layer. The granules, although discernible, are very poorly developed, many are vague in outline, and all are intermixed with considerable loose structureless material. The organic matter occurs chiefly as a coating around the granules, is not so thoroughly mixed with the mineral soil particles, and is less abundant than in the surface layer. The coating, however, is rather thick in the upper 2 or 3 inches of the layer, making that part as dark as the overlying layer. The coating decreases in thickness with depth, and the lower part of the layer is dark brown. These colors apply to the soil material as it appears in a natural exposure where only the dark coating which covers the granules is visible. When the layer is cut with a sharp instrument or the material from it is crushed, thereby exposing the lighter-colored interior of the granules, the soil becomes lighter in color, being dark brown in the upper part of the layer and brown in the lower part. This layer contains a somewhat higher percentage of clay than the surface layer. On drying, it cracks vertically into roughly shaped columns from 3 to 6 inches in diameter. The columns are very fragile and break readily into a semigranular or more or less structureless mass containing numerous irregular soft clods.

(3) The third layer, which occurs between depths of 18 and 30 inches, is the layer of maximum compaction. The compaction, however, is scarcely noticeable, and there is apparently no unusual accumulation of clay. The soil particles are grouped into larger units than in the layer just above, and columnar breakage is better defined. The columns break into soft irregular clods about one-half inch in diameter. The clods, because of the continued thinning, with depth, of the coating of dark organic matter, are lighter in color than the granules of the overlying layer. They have dark-brown surfaces with yellowish-brown centers. A crushed or powered lump from the upper part of the layer is yellowish brown, but one from the lower part has more of a yellowish-gray color. Throughout the mass some burrows from one-quarter inch to nearly an inch in diameter are filled with material which in most places differs in color from the undisturbed mass. It may be dark material from the upper layers or yellowish material from the one below.

(4) The material comprising the fourth layer continues to a depth of about 40 inches. It is yellowish or grayish yellow, and the breakage into lumps or units is less definite than in the layer just above. The units are less regular in form and are larger. They, also, are

coated with dark material, but it is brown rather than dark brown. The texture is somewhat lighter than that of the third layer. A great many borings, presumably of insects, penetrate the mass in all directions and constitute a considerable part of it. The material filling some of these borings is dark colored, but in the greater number it is lighter in color than the rest of the mass. In the lower part of this layer the breakage into structure bodies or particles is indefinite.

(5) The material between depths of 40 and 46 inches is yellowish-brown, friable, silty, and structureless and is free from carbonate of lime. It is underlain by yellowish-brown, friable, silty, structureless material which contains lime carbonate.

Holdredge silt loam and Holdredge very fine sandy loam, together with a flat phase of the silt loam, were mapped in Buffalo County.

Variation from this profile is the basis for the differentiation of nearly all the types of soil in the county. Differences in the degree of weathering, caused largely by variations in drainage conditions, surface features, and other conditions, may either have altered the position of or removed the carbonate zone or otherwise changed the character and color of the soil material, as in the flat phase of Holdredge silt loam.

Immature soils.—The light-colored Colby soils may be regarded as immature. Constant erosion has prevented the accumulation of much organic matter and as the surface water flows rapidly from the slopes, leaching of the carbonates from the subsoil does not proceed faster than the new material is exposed as a result of erosion. The surface layer is thin and lighter in color than that of the Holdredge, Hall, or Waukesha soils. The brown, slightly compact subsoil layer of the Holdredge soils is lacking and the brown surface layer rests directly on light-colored loess. The Colby soils are characterized by brown or ash-gray topsoils and light-yellow or almost white, highly calcareous subsoils. The change from topsoil to subsoil is abrupt. The Colby soils have developed from loess and are silty, except where wind-blown sand has modified the texture. They occur in upland positions and the surface varies from steeply sloping to extremely rough and dissected. In most places drainage is excessive and erosion is severe. The soils occur wherever erosion has greatly thinned or entirely removed the deep, dark surface layers of the Holdredge soils and exposed the light-gray, highly calcareous subsoil. In this county Colby silt loam, Colby very fine sandy loam, and Colby fine sandy loam are recognized.

The soils of the Valentine series and dunesand also belong to the immature upland soils. They have developed from accumulations of wind-blown or water-laid sand. The accumulations are either of such recent origin or have been so continuously shifted about by the wind that they have accumulated very little organic matter and have not developed definite layers in their profiles. The soil material is almost entirely quartz. Any soluble carbonates which it may have contained were rapidly leached away through the loose, porous sands.

The Valentine series includes soils with brown or grayish-brown topsoils and subsoils which consist of loose sand which varies in color from light brown to gray. The surface layers contain small

quantities of organic matter and clay, which give some of them a loamy texture. Both topsoils and subsoils are poor in lime. These soils have developed on wind-blown sands which have become stable. The surface varies from dunelike to almost level. Most areas occupy the lower positions, including the dry valleys and flats within the sand-hill region. In this county, however, this series is represented by small areas of sandy soils, the parent material of which is a mixture of sand originating from beneath the loess and from the channel and alluvial lands of South Loup River. Drainage is in most places excessive. Surface channels are not established, but the moisture seeps away through the loose, porous subsoil. Valentine sand and Valentine loamy sand have been mapped in Buffalo County.

Dunesand is simply areas of wind-blown sand having a hilly relief. It belongs to no soil series.

TERRACE SOILS

The terrace soils of Buffalo County include the members of the Waukesha, O'Neill, and Sparta series, all of which occur on well-drained terraces or benches.

The Waukesha soils have dark-brown or black granular topsoils and yellowish-brown or brown fine-textured subsoils. The subsoil material is slightly heavier than that of the topsoil but has not developed a compact claypan structure. It is in most places low in lime to a depth greater than 3 feet. The soils have weathered on water-assorted glacial and loessial materials and occur on terraces or benches along the larger streams. The surface is flat or very gently undulating, and the drainage is good. Waukesha silt loam and Waukesha very fine sandy loam occur in Buffalo County.

The Hall soils have dark-brown or black granular topsoils. The upper subsoil layers are brown and slightly compact and in most places grade, at a depth of 18 or 20 inches, to brown, dense, compact silty clay. Below a depth ranging from 24 to 30 inches, the material is gray or grayish-yellow, friable, and highly calcareous silt or silty clay. In this county these soils have not everywhere developed an extremely compact layer in the subsoil, and the profile over considerable areas is very similar to that of the Holdredge soils. The Hall soils occur on well-drained terraces. Areas are flat or very gently undulating. The soils differ from those of the Waukesha series chiefly in the lighter color and higher lime content of their subsoils. Hall silt loam, Hall very fine sandy loam, and Hall fine sandy loam are mapped in this county.

The O'Neill soils have brown or dark-brown more or less structureless topsoils underlain by gray or light grayish-brown, loose, sandy subsoils. Neither the topsoil nor the subsoil contains sufficient lime to react noticeably with acid. The soils occur on terraces or benches along the major streams. Areas are flat or gently undulating. The underdrainage is in most places excessive, owing to the porosity of the subsoil, and most of the soils are somewhat droughty. These soils differ from those of the Waukesha series in their more sandy and less coherent subsoil and in the smaller quantity of organic matter in the surface layer. In Buffalo County, the series is represented by O'Neill very fine sandy loam and O'Neill loamy fine sand.

The Sparta series includes soils which have light-brown or gray structureless topsoils and gray subsoils of loose, incoherent materials composed largely of sand and gravel. These soils are low in lime and organic matter. They occur on terraces and have developed principally from coarse stream sediments. Areas are level or gently undulating. The soils are usually droughty on account of excessive under-drainage. Sparta sand occurs in Buffalo County.

BOTTOM-LAND SOILS

Many of the soils of the county have developed under imperfect drainage conditions, so that oxidation has been retarded. These poorly drained soils include those of the Scott series, which occur in the basinlike depressions, and those of the Cass, Lamoure, Wabash, and Sarpy series, together with riverwash, which occur on the first bottoms or flood plains. The moist conditions have especially favored an excessive growth of vegetation, so that all the poorly drained soils, except the Sarpy soils which occur on recently laid alluvium and are rather light in color, have dark-colored surface layers. Owing to the poor aeration most of the flood-plain soils have gray or mottled gray and yellow subsoils.

The Scott soils do not belong to the bottom-land group of soils, as they occur on the uplands and terraces. They are extremely poorly drained, however, and in this arbitrary classification are therefore grouped with the poorly drained bottom-land soils.

The topsoils of the Scott soils are very dark brown or black. The upper part of the subsoil is in many places ash-gray, calcareous, silt loam material which grades downward to dark olive-drab, stiff, impervious clay. In this county, however, the ash-gray layer is in most places absent, and neither the topsoil nor subsoil contains sufficient lime to produce a noticeable reaction with acid. These soils occur in shallow basins on the terraces and scattered over the more level parts of the uplands. As the areas have no outlet, water stands over them after rains. Only one member of this series, Scott silt loam, has been mapped in Buffalo County.

The Cass soils have dark-brown or black topsoils and brown or gray lighter-textured subsoils. The subsoil material grades downward, within a depth of 3 feet, to sand and gravel. Both topsoil and subsoil may be highly calcareous. These soils occur on flood plains along streams and are, as a rule, poorly drained. They differ from the Lamoure soils in having more sandy and less coherent subsoils. The loam, clay loam, very fine sandy loam, fine sandy loam, and loamy fine sand members of the series have been mapped in this county.

The Lamoure soils have dark-brown or black topsoils. The subsoils vary in color from grayish brown to gray or mottled gray and brown and are commonly heavier in texture than the topsoils. The subsoils and, in many places, the topsoils are very calcareous. These soils are poorly drained and are locally subject to overflow. They occur on stream bottoms or as poorly drained areas on the terraces. In this county Lamoure silt loam, Lamoure very fine sandy loam, and Lamoure silty clay loam have been mapped.

The Wabash soils are characterized by very dark brown or black topsoils and heavy and usually compact dark-gray or drab subsoils.

The material from which the soils have weathered is of alluvial origin, having been washed from the loessial and associated uplands and deposited within the flood plains along streams. The surface is flat. Drainage is variable but in most places is adequate for crop production. These soils differ from the Lamoure soils in having a lower lime content and darker-colored subsoils. Wabash clay loam has been mapped in this county.

The soils of the Sarpy series are similar to the Cass soils in every respect, except in the lighter color of their topsoils. Sarpy sand and Sarpy loamy very fine sand have been mapped.

Dunesand and riverwash are miscellaneous materials not classed in any soil series. The former includes areas of wind-blown sand having a hilly relief, and the latter comprises small islands, bars, and flats composed of almost pure sand and gravel within and bordering the larger stream channels.

In the following pages the soils of Buffalo County are described in detail, and their relation to agriculture is discussed. The accompanying map shows their distribution in the county, and the following table gives their acreage and proportionate extent:

Acreage and proportionate extent of the soils mapped in Buffalo County, Nebr.

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Holdredge silt loam.....	189,248	33.3	O'Neill loamy fine sand.....	6,272	1.0
Flat phase.....	14,208		O'Neill very fine sandy loam.....	2,880	.5
Holdredge very fine sandy loam.....	12,288	2.0	Lamoure very fine sandy loam.....	3,776	.6
Colby silt loam.....	109,504	17.9	Lamoure silt loam.....	6,720	1.1
Colby very fine sandy loam.....	13,632	2.2	Lamoure silty clay loam.....	2,240	.4
Colby fine sandy loam.....	8,640	1.4	Valentine sand.....	20,032	3.3
Waukesha silt loam.....	81,536	13.3	Valentine loamy sand.....	1,856	.3
Waukesha very fine sandy loam.....	30,080	4.9	Sparta sand.....	9,344	1.5
Hall silt loam.....	26,112	4.3	Sarpy loamy very fine sand.....	640	.1
Hall very fine sandy loam.....	7,104	1.2	Sarpy sand.....	5,120	.8
Hall fine sandy loam.....	2,368	.4	Scott silt loam.....	1,536	.3
Cass loamy fine sand.....	10,944	1.8	Wabash clay loam.....	640	.1
Cass fine sandy loam.....	19,540	3.2	Dunesand.....	7,296	1.2
Cass very fine sandy loam.....	11,264	1.9	Riverwash.....	1,856	.3
Cass loam.....	704	.1			
Cass clay loam.....	3,520	.6	Total.....	611,200	-----

HOLDREDGE SILT LOAM

Holdredge silt loam has the profile described in detail in the section on soils. The surface material is very dark grayish-brown or almost black silt loam having an average depth of about 6 inches. It has no definite structure, is very friable, and is so thoroughly mixed with organic matter that the color is uniform throughout and is not changed by crushing. The next lower layer is faintly granular. The soil particles are more or less grouped into rounded or subangular granules, varying in size from that of a pinhead to more than one-eighth inch in diameter. The color of the upper part of this second layer is the same as that of the surface soil, but the dark material is only a coating on the surface of the granules. When the granules are crushed the material is dark brown. The dark coating becomes fainter with depth and the almost black material gradually becomes brown. The soil of this layer is slightly heavier in texture than that of the surface layer, being heavy silt loam. When dry the

soil material cracks vertically, forming columns from 3 to 5 inches in diameter. This layer continues to a depth of about 18 inches and is underlain by a transitional layer through which the color becomes lighter downward with the thinning of the dark coating, the average color being light grayish brown. The material loses the faintly granular condition of the layer above and breaks into small clods. Columnar form is as marked as in the layer above and the columns break up readily into small clods which may be easily crushed to loose silt loam or silty clay loam. This layer continues to a depth of about 30 inches. In the next lower layer, which continues to a depth of 40 inches, the basic color is grayish yellow. A few streaks and patches of dark-colored material from above may occur in worm and insect borings, but most of the borings are filled with light-colored material from below. This layer is underlain by grayish-yellow or yellowish-brown, friable structureless silt loam which is firm in composition but is not compact. It breaks up readily into soft irregular clods which may easily be reduced to loose, floury silt. Carbonate of lime is present at a depth ranging from 46 to 60 inches.

This soil, as a whole, is remarkably uniform in color and texture over large areas, but it has a few minor variations. On the sharper ridges and steeper slopes the soil may be lighter in color than typical and the subsoil material may occur at lesser depths, depending on the extent of erosion to which the surface layers have been subjected. In a few places, especially around canyon heads and on gullied slopes, erosion has entirely removed the dark layers, exposing the yellowish-gray, highly calcareous subsoil. Around the base of some of the longer and more gradual slopes colluvial wash from the higher levels has considerably thickened the surface layers and darkened the upper part of the subsoil and the light-gray lower part is seldom found at a depth less than 3 feet. Most of the above variations are of such small extent and small local importance as not to warrant separation on the soil map.

Holdredge silt loam is the dominant upland soil of Buffalo County and constitutes the greater part of the tillable land north of Platte Plain. It occurs chiefly on the broad divide between Platte and South Loup Rivers, but is also extensive on the north side of the latter stream. The soil is derived from loess under conditions favorable to deep weathering and the accumulation of organic matter.

The surface of areas of this soil varies from very gently undulating to steeply rolling. By far the greater acreage has a gently undulating or rolling relief. Most of the soil occupies the broader divides between minor drainage ways. In many places the soil extends for a considerable distance down the more gradual slopes and may border the lower, severely eroded Colby soils. In the western part of the county, where the relief is very pronounced and erosion is severe, the soil occurs exclusively on rounded hilltops and narrow, irregular divides.

Drainage is good and in places is excessive. Surface channels are not everywhere established, but there is usually sufficient slope to carry off the surplus moisture, and the porous subsoil affords good underdrainage. In the rougher parts of the uplands, erosion is reducing the hilltops and narrow divides, so that areas of the Colby

soils are gradually becoming larger and those of Holdredge silt loam smaller.

Holdredge silt loam is one of the best upland soils of Buffalo County. In natural productiveness it equals the leading upland soils of the Mississippi Valley. Crop yields, however, on account of the lower rainfall, are seldom so large as those obtained in the eastern States. In seasons of heavy rainfall, the yields of corn and alfalfa are almost twice those of normal years. About 85 per cent of the soil is under cultivation, and the remainder is used for pasture land, for the production of hay, or for feeding lots and farm sites.

Holdredge silt loam originally supported a thick growth of grasses and was extensively used for grazing. There are still many small tracts of the original prairie sod. Grama and buffalo grass predominate, and together with considerable western wheatgrass, blue-stem, wiregrass, and other grasses, furnish excellent hay and pasture except in the driest years. Western wheatgrass is preferred for hay. Pastures are open from about May 15 to October 1, and are usually in the best condition during June. The soil was originally treeless, but there are now planted groves of ash, box elder, elm, and cottonwood on many of the farms.

Corn, wheat, alfalfa, and oats are the leading cultivated crops although considerable rye, barley, millet, cane, and Sudan grass are grown for feed.

Crop yields vary widely from year to year, depending on the rainfall. Good yields are obtained in normal years. The average yield of corn is about 25 bushels to the acre. Wheat yields from 10 to 25 bushels, with an average of about 15 bushels to the acre. It is the chief cash crop, as most of the corn is used for feeding purposes. Oats, grown for feed on nearly every farm, yield from 25 to 35 bushels to the acre. Alfalfa yields from 2 to 2½ tons from three cuttings. The average yield of rye is about 18 bushels and of barley 20 bushels to the acre. The native grasses support from 200 to 300 cattle a section (640 acres) during the summer grazing season, or when cut for hay yield from one-third to three-fourths ton to the acre.

Cattle raising is not practiced extensively, as most of the land is better suited to crop production than to grazing. Many farmers, however, feed cattle during the winter months, and all the native livestock, except a few kept to supply the dairy needs for food, are fattened for market. Some cattle are annually imported for feeding. The native cattle are chiefly grade Hereford and Short-horn. Hogs are raised on every farm, and many farmers have large herds. All livestock intended for market is fattened on corn and alfalfa and is shipped to Omaha.

Crop rotation is not systematically practiced, although the more progressive farmers grow corn one or two years, oats one year, wheat from one to three years, and alfalfa from four to six years or as long as the stand remains profitable. Little alfalfa is grown on the tenant farms. Many renters grow corn or wheat on the same land for several years.

Modern machinery is in general use. Four-horse teams do most of the farm work, though tractors are sometimes used on the more level areas.

Barnyard manure is the only fertilizer used, and the supply is seldom adequate for best results.

Holdredge silt loam sells at prices ranging from \$70 to \$100 an acre, depending on improvements, surface relief, and location with respect to markets.

Holdredge silt loam, flat phase.—The surface material of this flat land is dark grayish-brown or black silt loam, from 12 to 15 inches deep. The upper 6 or 8 inch layer contains more organic matter and is considerably darker than the lower part. It is also loose and pulverulent, in contrast to the finely granular structure of the subsurface layer. The upper part of the subsoil is light grayish-brown silty clay or silty clay loam material and continues to an average depth of 28 inches. It has a coarsely granular or cloddy structure, is hard, brittle, and slightly compact when dry but nowhere resembles a claypan. The lower part of the subsoil is generally lighter in texture and color than the layer above and continues to a depth of more than 3 feet. The substratum consists of loose, floury silty clay varying in color from ash gray to pale yellowish gray. The parent loess occurs at a depth ranging from 4 to 6 feet, depending on the relief. The content of organic matter gradually decreases with depth, and this substance is practically absent below a depth of 3 feet. The granular structure of the subsurface material results from the concentration of clay particles brought down by percolating water.

This soil is in few places calcareous within a depth of 4 feet, and in many places no lime reaction is obtained with dilute hydrochloric acid within 6 feet of the surface. As a rule, however, a faint calcareous reaction is obtained at a depth of about 5 feet.

Holdredge silt loam, flat phase, is remarkably uniform throughout its occurrence in Buffalo County. The thickness and color of the several soil layers, as well as the depths of the calcareous material in the substratum, vary slightly in different localities, but these variations are of such small extent and slight local importance as not to warrant separation on the soil map.

Holdredge silt loam, flat phase, occurs chiefly as narrow, elongated areas on the higher and more nearly level divides north of Wood River in the central part of the county. The areas extend in a general north-south direction parallel to minor drainage ways. The soil occurs only in small areas south of Wood River on the higher and more nearly level parts or the divides which represent uneroded remnants of the original loess plain. The surface is flat or very gently undulating and is modified by small, shallow, basinlike depressions seldom exceeding 1 or 2 acres in size. Drainage is good. Surface channels are not established, but the slope is in most places sufficient, even on the flatter areas, to carry off the surplus moisture, and the porous subsoil affords ample underdrainage. Water usually collects in the depressions after rains, but the total area of poorly drained land is almost negligible.

The soil of this phase is important in the agriculture of Buffalo County. This is the best upland soil of the area. Its level surface, silty stone-free character, and high fertility make it well adapted to all the staple crops common to the region. Practically all of it is under cultivation. The same crops are grown as on Holdredge

silt loam, and yields usually average a trifle higher. The cattle industry consists only of the winter fattening of beef animals, and the raising of enough milk cows to supply the home dairy needs and a small surplus of dairy products for sale in the local markets. Hogs are raised extensively.

This soil is easily managed and can be cultivated under a rather wide range of moisture conditions. It clods badly if plowed when wet, but the lumps are easily reduced. Barnyard manure is applied when available. Although crop rotation is not systematically practiced, considerable alfalfa is grown and the soil is in no immediate danger of becoming exhausted.

The current value of this land ranges from \$80 to \$125 an acre, depending largely on improvements and location.

The following table gives the results of mechanical analyses of samples of the soil and subsoil layers of typical Holdredge silt loam and its flat phase:

Mechanical analysis of Holdredge silt loam

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Typical soil:—								
375401....	Soil, 0 to 8 inches.....	0.0	0.6	0.4	3.6	41.6	46.1	7.8
375402....	Subsoil, 8 to 15 inches....	.2	.2	.1	1.4	36.9	50.1	11.7
375403....	Subsoil, 15 to 30 inches....	.0	.0	.0	.6	31.6	59.0	9.1
375404....	Subsoil, 30 to 60 inches....	.0	.0	.0	.2	37.4	55.8	6.6
Flat phase:—								
375405....	Soil, 0 to 8 inches.....	.0	.4	.3	2.4	34.1	54.8	8.5
375406....	Subsoil, 8 to 15 inches....	.0	.0	.0	.9	34.8	52.9	11.7
375407....	Subsoil, 15 to 30 inches....	.0	.0	.1	.5	20.7	50.6	28.5
375408....	Subsoil, 30 to 40 inches....	.0	.0	.0	.3	33.7	47.6	19.0

HOLDREDGE VERY FINE SANDY LOAM

The surface material of Holdredge very fine sandy loam is grayish-brown or dark grayish-brown very fine sandy loam from 6 to 10 inches deep. It contains a larger proportion of sand than is usual in very fine sandy loam and is rather loose and mellow. Deeper down is an 8 or 10 inch layer of slightly darker very fine sandy loam material which has an imperfectly developed, finely granular structure. This is apparently the lower part of an old surface layer, whose upper part or the present surface material has been slightly modified in texture and color by wind-blown sand. The upper subsoil layer consists of grayish-brown slightly compact silt loam or very fine sandy loam material having a coarsely granular or cloddy structure. This material is very friable in its natural condition but becomes rather hard and brittle on drying. This layer is underlain, at a depth of about 30 inches, by ash-gray or pale yellowish-gray loose, floury silt. The substratum of loess, which represents the parent material, occurs at a depth ranging from 5 to 6 feet. The subsoil is not noticeably calcareous, but below an average depth of 34 inches carbonate of lime in a finely divided form is usually abundant.

In this county the surface soil of this soil type is not very uniform in color and texture. Those areas lying near or adjacent to areas of sandy soils have accumulated a comparatively large proportion of wind-blown, very fine sand in their surface layers and are consequently

lighter in color and coarser than typical. In many places where areas of this soil are surrounded by loessial soils, the surface layers contain so little sand as to approach silt loam in texture. Holdredge silt loam and Holdredge very fine sandy loam merge so gradually into one another that in many places it is necessary to draw arbitrary lines in separating them. Around canyon heads and on steep gullied slopes the surface soil has been greatly thinned and in places entirely removed by erosion, and small patches of the light-colored subsoil and substratum are exposed. Where such areas are of sufficient size to warrant mapping, they were classed with Colby silt loam or Colby very fine sandy loam, depending on the quantity of sand in the surface layers.

Holdredge very fine sandy loam is not very extensive, although it occurs in numerous irregular areas scattered throughout the uplands on both sides of South Loup River. Most of the areas are small, ranging in size from a few acres to about 3 square miles. One of the largest is about 5 miles southward of Poole, on the west side of Sand Creek. A smaller area of very typical soil may be seen along the Buffalo-Sherman County line north of Poole. Other areas are west of Ravenna, northeast of Pleasanton, south of Peak School, and on the south side of Sweet Creek.

This soil has weathered from sandy loessial material. The silty surface soil of what was formerly an area of Holdredge silt loam has become so intermixed with wind-blown sand from the coarse-textured bottom-land and terrace soils that it has acquired a very fine sandy loam texture.

Areas of this soil range from almost flat to sharply rolling. The greater part of the land has a rolling surface modified by numerous steeply sloping strips where minor drainage channels have cut into the loose loessial deposit. A few of these areas occur on long, gradual slopes between the uplands and terraces or flood plains bordering South Loup River and its tributaries.

Drainage is everywhere good. The slope is sufficient, even on the flatter areas, to carry off the surplus moisture, and the porous subsoil affords ample underdrainage. On a few of the more steeply sloping areas surface run-off is excessive, erosion is severe, and the areas of the Colby soils are gradually increasing at the expense of this soil.

This soil, on account of its small total area, is of only moderate importance in the agriculture of Buffalo County. It is naturally strong and fertile, however, and all crops common to the region do well in favorable seasons. It can be tilled under a somewhat wider range of moisture conditions than can Holdredge silt loam, because of the larger proportion of sand in its surface layer. The large content of organic matter prevents wind erosion, and the soil is stable even in the driest seasons.

About 85 per cent of this soil is under cultivation to corn, oats, wheat, and alfalfa. The remainder is included in farm sites and pasture land. The native vegetation consists of a great variety of prairie grasses of which buffalo, grama, bluestem, and wheatgrass are the most important. A few farmers feed cattle during the winter, though this industry is not practiced so extensively as it is on Holdredge silt loam.

Crop yields are about the same as those obtained on the heavier upland soils, and the land is managed in much the same manner. The loose surface soil lends itself admirably to the formation of a surface mulch, and the soil is very retentive of moisture. During dry seasons crops often withstand droughts better than those on the silt loam.

The current value of this land ranges from \$65 to about \$90 an acre, depending largely on improvements and location.

COLBY SILT LOAM

The topsoil of Colby silt loam is grayish-brown, light grayish-brown, or ash-gray friable silt loam from 4 to 8 inches deep. The upper part of the subsoil is of similar or slightly lighter color, but is identical in texture and structure. The lower subsoil layer, occurring at a depth varying from 12 to 15 inches, consists of light-yellow open and friable material of silty or silt loam texture. It has the characteristic smooth, floury texture of the loess material from which it is derived and grades with depth to the very light colored, unweathered parent loess. As the color indicates, the soil is low in organic matter. The surface layer is in most places slightly calcareous, and the subsoil contains much lime.

The principal variations in this soil are in the depth and color of the surface soil. Variations depend largely on the lay of the land and the severity of erosion to which the soil has been subjected. On the more gradual slopes and more rounded divides, conditions have favored vegetative growth and decay, and the surface soil is deeper and darker than typical. On steeply sloping areas, erosion has prevented the accumulation of organic matter, and the soil is consequently light in color. In many places, the surface layers have been entirely removed by erosion, exposing the light yellowish-gray parent loess. The marginal areas adjoining the sandy soils show considerable variation in texture, grading through loam to very fine sandy loam. The above variations are important only locally and do not warrant separation on the soil map.

Colby silt loam is one of the most extensive upland soils, ranking next to Holdredge silt loam in total area. It occurs chiefly in the western part of the county where erosion has been especially severe, as in Harrison, Armada, Logan, Elm Creek, and Odessa Townships. It is also extensive in nearly all parts of the uplands. The soil has been subjected to the same forces of soil development as has Holdredge silt loam, but the dark surface layer has been removed by erosion, so that the light-colored subsoil or substratum has become exposed.

Areas of this land vary from rolling to extremely rough and dissected. Even areas of moderate relief are dissected by numerous intermittent streams which have cut deep and, in places, almost perpendicular-walled valleys. Soil slipping is common in the rougher areas, and the slopes in many places present short vertical exposures having a steplike appearance. Drainage is everywhere thorough and in most places is excessive.

Colby silt loam is an important agricultural soil in Buffalo County. It contains less organic matter than the Holdredge soils, and its surface relief makes it less desirable for farming, but its large extent

tends to make it one of the most important upland soils. About 50 per cent of it is under cultivation. The remainder, including the rougher areas, is used for grazing and the production of hay. The native vegetation consists of a luxuriant growth of grama grass, bunch grass, redbud, western wheatgrass, buffalo grass, bluestem, and many other nutritious grasses.

Corn, wheat, alfalfa, oats, and rye are the most important cultivated crops. Wheat is usually the chief cash crop, although on farms where little livestock is kept most of the corn is sold. Many farmers grow wheat or corn on the same land continuously for several years. Considerable sorghum, millet, and Sudan grass are grown for feed. Most of the farms on this soil have small orchards which do well in favorable seasons. Cattle, of which Hereford is the principal breed, are grazed on the rougher areas. A few farmers feed livestock for eastern markets.

Crop yields are controlled largely by moisture conditions, the condition of the soil, and the care used in cultivation. The average crop yields are a trifle lower than those obtained on the Holdredge soils. Corn yields from 15 to 50 bushels, with an average of about 20 bushels to the acre. The average yield of wheat over a period of years is about 12 bushels to the acre, although in favorable seasons from 20 to 30 bushels are obtained. As the soil is loose and friable and contains much lime it is exceptionally well adapted to alfalfa, and the yields range from $2\frac{1}{2}$ to 3 tons to the acre from three cuttings. The crop is an excellent one for the soil, as it adds nitrogen, prevents erosion, and increases the organic-matter content. The average yield of oats is about 25 bushels and of rye 20 bushels to the acre. The native grasses on this soil support from 150 to 200 cattle on each square mile during the summer grazing season from June to October.

This soil is easy to manage if care is taken to prevent washing on the steep slopes. Commercial fertilizers are not used, but available barnyard manure is applied. Systematic crop rotation is not practiced, although most farmers change their crops with reasonable regularity and grow alfalfa frequently.

Current values of Colby silt loam range from \$35 to \$75 an acre, depending on improvements, lay of the land, distance from markets, and the adaptability of the soil to crop production. The lower price applies to land suitable only for grazing.

The control of erosion is of primary importance in the utilization of this soil, which, in its virgin state, is naturally productive. The relief, however, is unfavorable for the accumulation of organic matter, and when the native sod is destroyed the land soon becomes gullied and uncultivable unless otherwise protected from erosion. Alfalfa is one of the most valuable crops for this soil, but sweet clover is also very beneficial. On the steeper hillsides erosion could be retarded by terracing and by plowing, planting, and cultivating the crops at right angles to the slope.

COLBY VERY FINE SANDY LOAM

Colby very fine sandy loam differs from Colby silt loam only in having a larger proportion of sand in its surface layer. The topsoil, to a depth ranging from 4 to 6 inches, is grayish-brown or

light grayish-brown friable very fine sandy loam. The upper part of the subsoil contains less sand than the topsoil and is slightly lighter in color, being ash-gray or yellowish-gray silt loam material. It is loose and friable. The lower part of the subsoil, which begins at an average depth of about 18 inches and continues to the underlying substratum of loess, is light yellowish-gray silt or silty clay which feels smooth and floury. The loess occurs at a depth ranging from 24 to 40 inches, depending on the surface relief and the degree of erosion to which the overlying soil layers have been subjected. The soil is low in organic matter, as the color indicates. The subsoil layers are rich in lime, and even the surface layer in most places contains a sufficient quantity of carbonates to react with dilute hydrochloric acid.

This soil is not very uniform in texture in Buffalo County; it varies from silt loam to fine sandy loam, depending on the quantity of wind-blown sand which has become incorporated in the surface soil. Small areas having one or another of the above textures are included, as Colby silt loam, Colby fine sandy loam, and Colby very fine sandy loam in many places merge into one another so gradually as to necessitate the drawing of arbitrary lines in separating them. As a whole, however, the soil contains about the correct proportion and grade of sand to give it the texture of very fine sandy loam. There is some variation in the color of the surface layer depending largely on the position of the area. The more gradual slopes and broader divides have favored greater accumulation of organic matter than the severely eroded areas, and in such places the surface soil is naturally darker than typical. In many places on the steeper slopes, erosion has entirely removed the topsoil and subsoil layers, exposing the light-gray highly calcareous parent loess.

Colby very fine sandy loam does not cover a large area in this county. It occurs as numerous, though usually small, areas throughout the South Loup River drainage area in the northern part. Many of these areas are on slopes bordering the alluvial lands along the river and its tributaries. Two of the largest occur on both sides of Otter Creek, in the extreme northwestern part of the county. Another patch is northwest of Ravenna. A small, though typical area is about 2 miles east of Houston School in the north-central part of the county. Patches extend across the boundary line between Buffalo and Sherman Counties.

This soil has developed from loess, the surface of which has been considerably modified by wind-blown sands from the surrounding soils and by sandy materials within the loess itself.

The relief is seldom so pronounced as that of areas of Colby silt loam. Most areas range from gently rolling to hilly. In many places the land is rough and dissected, but the total area of such land is very small. The greater part of the soil occurs on long, gently rolling slopes between the uplands and the valley floor. Drainage is everywhere good, and on many of the steeper slopes is excessive and causes severe erosion.

Colby very fine sandy loam is not very important in the agriculture of Buffalo County on account of its small extent and patchy occurrence. It is a fairly productive soil, however, and is equal to Colby

silt loam for farming purposes. About 80 per cent of it is under cultivation. The remainder is used chiefly for grazing. The native vegetation includes the same grasses that thrive on Colby silt loam, and in addition sand grass and needle grass are common. All crops adapted to the region can be successfully grown, with yields about the same as those on Colby silt loam. The soil is managed in the same manner as the other loessial upland soils of the county.

This land brings from \$35 to \$75 an acre. Improvements, the lay of the land, and location are the principal factors which determine land values.

COLBY FINE SANDY LOAM

The topsoil of Colby fine sandy loam is loose, friable, grayish-brown fine sandy loam, from 4 to 6 inches deep. The upper part of the subsoil, to an average depth of about 15 inches, is only slightly lighter in color but contains a finer grade and smaller proportion of sand than the layer above, being loose, friable, very fine sandy loam in texture. The lower part of the subsoil is light-gray or yellowish-gray floury silt or silty clay and closely resembles the corresponding layer of Colby silt loam and Colby very fine sandy loam. It rests on the parent loess at a depth ranging from 30 to 40 inches. All soil layers are low in organic matter. The topsoil in most places contains a small quantity of lime, and the subsoil layers are highly calcareous. The large proportion of sand in the topsoil and upper subsoil layer is due chiefly to the addition and thorough mixing of wind-blown sand from the near-by Valentine and bottom-land soils.

This soil is fairly uniform throughout its occurrence in Buffalo County, but it includes a few variations in texture and color. Marginal areas bordering sandy soils may contain so much coarse material as to become loamy sand in texture, and patches of Colby loamy sand are included with this soil. The upper subsoil layer of such areas is decidedly coarser than typical, being fine sandy loam in texture, but the lower subsoil layer differs little from the typical.

On the steeper slopes and sharper ridge crests, the surface soil of Colby fine sandy loam is in most places lighter in color than elsewhere on account of the unfavorable conditions for the accumulation of organic matter. In a few places, erosion has entirely removed the topsoil and subsoil layers, exposing the light-colored underlying loess. The above variations are so inextensive and of such minor importance as not to warrant separation on the soil map.

Colby fine sandy loam occurs in a few small and isolated areas scattered throughout the drainage area of South Loup River in the northern part of the county. One of the largest areas is south of the stream in Harrison Township. A slightly smaller one is north of Pleasanton, and an area of the most typical soil is south of this town. The remaining patches are small, few exceeding 320 acres in size.

Colby fine sandy loam evidently has developed originally from loessial deposits. The surface of this deposit, however, has been greatly modified by the addition of sandy materials. The wind may have carried the sand to its present position from the coarser textured Valentine and alluvial soils, or the sand may have been derived from sandy materials within the loess. Probably both sources have contributed. In either event, wind action has so modified, mixed,

and reassorted the loess and sand that no definite statement can be made in regard to the origin of this soil.

The relief varies from gently undulating to sharply rolling or hilly, and areas are modified in a few of the more exposed situations by choppy relief where the wind has whipped the loose, incoherent sand into low, rounded knolls and ridges. The greater part of the soil is rolling, except where it is cut by narrow V-shaped valleys along drainage ways. Drainage is everywhere good and in the rougher parts is excessive.

Owing to its small extent, the soil is of little agricultural importance. It is rather loose, incoherent, and subject to more or less drifting when the native sod is destroyed, but if carefully managed it produces fair yields of corn, alfalfa, sorghum, and kafir. About 60 per cent of it is under cultivation, and the remainder is used for grazing land. Small grain is seldom grown on account of the danger of the soil drifting and of consequent injury to the shallow roots. The native grasses include sand grass, stipa or needle grass, bluestem, and some grama grasses. Crop yields, with the possible exception of corn, are somewhat lower than on the heavier soils of the series.

The methods of farming are the same as those practiced on the heavier soils. The land is somewhat easier to manage, however, on account of its high sand content. It can be cultivated under any moisture condition without injury, provided care is taken to prevent the soil from blowing.

Colby fine sandy loam sells at prices ranging from \$30 to \$70 an acre, depending on the surface relief and improvements.

When corn is to be grown on this soil, the grain should be deeply listed in, with the furrows running at right angles to the prevailing northwest winds, if possible. Coarse manure and straw have also proved beneficial in keeping the soil stable. Alfalfa grows well and is an excellent crop to prevent drifting.

WAUKESHA SILT LOAM

The topsoil of Waukesha silt loam is very dark grayish-brown mellow silt loam from 12 to 15 inches deep. It is rich in organic matter and feels smooth and velvety. The upper part of the subsoil is grayish-brown, moderately compact silty clay loam or silty clay, and continues to a depth ranging from 24 to 36 inches. It is slightly plastic when wet but becomes moderately hard and brittle on drying. In places it is mottled with gray splotches and rust-colored stains. The lower part of the subsoil is light-yellow or yellowish-gray, loose, friable silt which continues with little change to a depth of more than 4 feet.

The transition between the topsoil and the upper subsoil layer is very gradual both in color and texture, whereas that between the two subsoil layers is very abrupt. Scattered lime concretions occur in places below a depth of 30 inches, but their presence is not characteristic, and the soil, as a whole, is not noticeably calcareous within a depth of 3 feet.

This soil is fairly uniform throughout its occurrence in Buffalo County, although variations, chiefly in the texture of the surface layers and in the thickness of the different layers, are present. The

principal textural variation approaches very fine sandy loam, and patches of Waukesha very fine sandy loam are included with this soil. Around the margins of the areas adjacent to the uplands the surface soil has been greatly thickened by the addition of colluvial wash from the higher slopes and consists of very dark grayish-brown or almost black, mellow silt loam from 18 to 24 inches deep. The surface soil grades abruptly to the grayish-brown, moderately compact silty clay of the upper subsoil layer, and the yellowish-gray, friable silt of the lower subsoil layer is not reached within a depth of 3 feet. In a few places, the soil profile closely resembles that of Hall silt loam in color and structure, the upper part of the subsoil being dark grayish-brown, extremely compact silty clay, underlain at a depth of about 24 inches by light yellowish-gray, loose, floury silty material which continues downward to a depth of more than 3 feet. The material, however, is everywhere low in lime within 3 feet of the surface, and for this reason it is classed with the Waukesha soils.

This soil is very extensive in Buffalo County. It is the dominant terrace soil along most of the major streams. It occurs in fairly continuous strips of different widths. Most of the terrace land on the north side of Platte River is of this type, although numerous areas of other soils are included within its borders. This soil is extensive along Wood River throughout its course across the county. It is the chief terrace soil along Sweet, Swenson, and Prairie Creeks, and throughout Buckeye Valley. It rarely occurs along South Loup River, as most of the terrace soils there are sandy.

Waukesha silt loam has developed on alluvial sediments deposited by the streams when they were flowing at higher levels. Surface wash from the adjoining uplands has also contributed to its formation, especially near the foot of the steeper slopes. The parent material is loesslike and has been described by Nebraska geologists as a valley form of loess.

Areas of this soil range from flat to very gently undulating. The soil occurs on several different bench levels which usually merge gradually into one another. In many places, however, the transition between the different terrace levels and between the low terraces and flood plains is marked by a rather short, steep slope. Drainage is everywhere good but is not excessive. There is usually sufficient slope, even on the more nearly level areas, to carry off all surplus water. None of the soil is subject to active erosion.

Waukesha silt loam includes some of the most valuable land in the county. Its level surface, silty character, and fertility make it highly prized for general farming. Practically all of it is under cultivation to corn, wheat, alfalfa, and oats, the crops ranking in acreage in the order named. Cattle feeding is an important industry, but very few cattle are grazed, as the largest returns are realized from grain farming. Most of the animals are of Hereford and Shorthorn breeds. They are either purchased from near-by ranches or are shipped in from mid-western markets for winter feeding. Hogs are raised on every farm, and many farmers have large herds. The principal breeds are Duroc-Jersey, Poland China, and Hampshire.

Crop yields average slightly higher than on the Holdrege soils of the uplands, on account of the more favorable moisture conditions. Corn yields from 30 to 60 bushels, with an average of

about 35 bushels to the acre. Wheat, yielding an average of about 20 bushels to the acre, is the chief cash crop as most of the corn is used for stock feeding. Alfalfa yields from $2\frac{1}{2}$ to $3\frac{1}{2}$ tons to the acre from three cuttings, and during favorable years a fourth cutting is often obtained. The average yield of oats is 35 bushels to the acre. This crop is grown only as a step in the rotation between corn and wheat or alfalfa. It is used as feed for work animals.

Crop rotation is not systematically practiced, although considerable alfalfa is grown. Available barnyard manure is applied, but the fertility of the soil has not been impaired to any appreciable extent. The soil receives more or less organic matter through surface wash from the higher levels. The land is easily kept in good tilth when it is worked under favorable moisture conditions. It usually clods if plowed wet, but the lumps are easily reduced by harrowing. Four-horse teams and gang plows are commonly used, and tractors are sometimes used for fall plowing.

The current selling price of Waukesha silt loam ranges from \$100 to \$150 an acre, depending largely on the improvements and location.

WAUKESHA VERY FINE SANDY LOAM

Waukesha very fine sandy loam has a topsoil, from 8 to 10 inches deep, of very dark grayish-brown, loose, friable, very fine sandy loam well supplied with organic matter. The subsoil, to an average depth of 18 inches, is only slightly lighter in color than the layer above, but in most places it contains a larger percentage of silt and clay and has a decidedly granular structure. It ranges in texture from loam to silty clay loam and is loose and friable. The lower part of the subsoil is brown or grayish-brown, moderately compact silty clay loam. It is rather sticky and plastic when wet but becomes hard and brittle on drying. In most areas this layer continues to a depth greater than 3 feet. The substratum, occurring at a depth of 4 or $4\frac{1}{2}$ feet, is light-yellow, loose, floury silty material which closely resembles the material which comprises the lower subsoil layer of the Holdredge soils. The soil is in few places noticeably calcareous within 3 feet of the surface. Below a depth of 4 feet, however, lime is very abundant both in the form of powder and as small concretions.

The topsoil on the marginal areas adjoining the uplands has been greatly thickened in places by colluvial wash from the higher slopes. The principal textural variation resembles silt loam, although in places the topsoil material contains so much sand as to approach fine sandy loam. It is possible that small areas of silt loam and fine sandy loam are included with this soil as mapped. All variations from the typical, however, were of such small extent and minor importance as not to warrant separation on the soil map.

Waukesha very fine sandy loam aggregates a large acreage in Buffalo County. It occurs chiefly in the southeastern part, including the Platte River bench lands, but it also occurs along many of the tributaries of South Loup River and on some of the terraces which border the main stream. The largest and one of the most uniform areas is south of the Union Pacific Railroad between Gibbon and Kearney. A smaller area of rather typical soil is mapped on the

same side of the track between Gibbon and Shelton. The soil is extensive along Cedar, Muddy, and Dry Creeks in the northern part of the county.

This soil has been developed by the weathering of alluvial materials which now occur as terraces or benches. Areas are flat or very gently undulating, usually with a gentle slope down the valley and toward the stream channels. Drainage is everywhere good, even the flatter areas having sufficient slope to carry off the surplus water. The surface is from 15 to 20 feet above the normal level of the streams and is nowhere subject to overflow.

Waukesha very fine sandy loam is an important agricultural soil in Buffalo County. It is considered equal to Waukesha silt loam for general farming, and all of it is under cultivation. Corn, wheat, alfalfa, and oats are the leading crops. The winter feeding of cattle and the raising of hogs are important industries. The cattle are mostly Shorthorn and Hereford, and the hogs are mainly Duroc-Jersey and Hampshire.

Crop yields on this soil are about the same as on the silt loam member of the series. In fact, most farmers do not recognize any difference between Waukesha silt loam and Waukesha very fine sandy loam. They are managed in the same manner, are regarded equally fertile, and have about the same sale value.

HALL SILT LOAM

Hall silt loam has a topsoil, from 10 to 15 inches deep, consisting of very dark grayish-brown, friable silt loam. It is rich in organic matter, which gives it its dark color. In most areas it contains a small percentage of very fine sand, but little coarser material. The upper part of the subsoil is grayish-brown compact silty clay which continues to an average depth of 20 inches. It is stiff and plastic when wet but becomes hard and tough on drying. This material merges into light grayish-brown, slightly less compact silty clay. Below a depth ranging from 30 to 34 inches the subsoil is friable ash-gray or light yellowish-gray highly calcareous silty material which continues to a depth greater than 3 feet. It has the smooth, floury texture so characteristic of loess material. The transition between the topsoil and the upper subsoil layers is rather abrupt, but that between the remaining soil layers is very gradual in color, texture, and structure. The lime, so abundant in the lower part of the subsoil, commonly occurs in the finely divided form.

A few variations occur. Scattered throughout mapped areas of this soil are numerous patches in which the carbonates have been leached to a depth greater than 36 inches, and in this respect the soil somewhat resembles Waukesha silt loam. Most of these patches, however, have a more compact upper subsoil layer and a lighter-colored lower subsoil layer than the Waukesha soil, and for this reason were mapped as Hall soils. In many places the heavy upper subsoil layer is poorly developed and may be entirely absent, the topsoil resting on loose, mellow, light grayish-brown silt or silt loam from 8 to 12 inches thick. At a depth below 24 inches, the subsoil is the typical yellowish-gray calcareous silty material. The principal

textural variation approaches very fine sandy loam, and areas of Hall very fine sandy loam too small and unimportant to warrant separation are scattered throughout mapped areas of this soil.

Hall silt loam is fairly extensive. It occurs in areas of different sizes, chiefly on the Platte and Wood River terraces in the southern part of the county and along Elm Creek in the extreme southwestern part. One of the largest areas, comprising about 7 square miles, is near the eastern county boundary between Wood River and Prairie Creek. The soil occurs in small areas along Wood River in the western and northwestern parts of the county and along Cedar Creek in the central part.

This soil has weathered from alluvial material of loessial origin deposited when the streams were flowing at a higher level. It occurs on terraces or benches of different ages and elevations. Areas are flat or gently undulating, with a gradual slope toward streams and down valleys. This land is from 10 to 25 feet above the stream channels and is well drained. The slope is in most places sufficient to give ample outlet for surface waters.

Hall silt loam is an important agricultural soil in Buffalo County. Practically all of it is under cultivation to corn, wheat, alfalfa, and oats. It is as strong and fertile as Waukesha silt loam and Waukesha very fine sandy loam, and during average years produces equally well. In very dry seasons, however, the heavy upper subsoil layer prevents a sufficiently free upward movement of soil moisture, and the yields of corn, especially, are sometimes lower than on the Waukesha soils. The raising of hogs is an important industry, and every farmer fattens a few head for market. Cattle grazing is not practiced extensively on account of the small acreage of pasture on the average farm. Many farmers, however, ship in cattle for winter feeding. The animals are fed corn and alfalfa for a period ranging from 60 to 90 days and are returned to the Omaha market. Some feeders buy their stock from local ranches. A few milk cows are kept on every farm to supply home dairy needs and a small surplus of dairy products for local markets.

The average yield of corn on this soil is about 30 bushels to the acre, of wheat 20 bushels, of oats 35 bushels, and of alfalfa from 2½ to 3½ tons from three cuttings.

The land is easily worked and maintained in good tilth, when it is plowed under favorable moisture conditions. If plowed wet it clods but the lumps are easily reduced. Four-horse teams and gang plows are commonly used. No commercial fertilizer is used, although available barnyard manure is applied. The supply is seldom sufficient to greatly increase the total crop yields, as the soil is naturally strong and fertile and is in no immediate danger of becoming exhausted.

Systematic crop rotation is not practiced. The more progressive farmers, however, change their crops frequently and grow considerable alfalfa. Alfalfa gives as good yields as on any soil in the county. The stands are usually maintained from five to seven years or as long as they remain profitable.

The current value of Hall silt loam ranges from \$100 to \$150 an acre. The sale price is governed largely by improvements and location.

HALL VERY FINE SANDY LOAM

The topsoil of Hall very fine sandy loam is dark grayish-brown or very dark grayish-brown very fine sandy loam, from 10 to 15 inches deep. It contains a comparatively high percentage of silt but scarcely any material coarser than fine sand. It is rich in organic matter and appears almost black when wet. The upper part of the subsoil is grayish-brown, slightly compact, and varies in texture from silt loam to very fine sandy loam. It continues to an average depth of 30 inches and is underlain by light grayish-brown, slightly compact, calcareous silty clay. The lower subsoil layer, which begins at a depth of about 40 inches, is ash-colored or light-gray calcareous silty clay which becomes lighter in color and looser in structure with depth. Below a depth of 4 feet it merges into yellow or almost white silty material which has the smooth, floury texture so characteristic of loess. The transition between all soil layers is very gradual in color, texture, and structure. As the color indicates, the content of organic matter gradually decreases with depth, and this substance is almost absent below a depth of 30 inches.

There are a few variations. In scattered patches the subsoil is not noticeably calcareous within a depth of 3 feet. Were these areas of sufficient size to warrant mapping they would be included with Waukesha very fine sandy loam. In a few places the slightly compact subsoil layers are entirely absent, and the upper subsoil layer consists of brown or grayish-brown friable silt loam or very fine sandy loam which becomes gradually lighter in color with depth until the light-gray or almost white floury silty material of the lower part of the subsoil is reached. The principal texture variations approach silt loam and fine sandy loam. In many localities the division line between the different soils is arbitrary, as the areas merge gradually in texture into one another.

Hall very fine sandy loam occurs almost exclusively in scattered areas on the Platte and Wood River terraces in the southern part of the county and in narrow strips along a few of the tributaries of South Loup River, in the northern part. One of the largest areas, comprising about $1\frac{1}{2}$ square miles, lies around Gibbon, in the southeastern part of the county. Small areas are along Otter Creek in the extreme northwestern part, along Cedar Creek southwest of Poole, and in the vicinity of Sweetwater.

The soil has weathered from alluvial deposits of loessial origin in the same manner as has Hall silt loam. The surface layer, however, has received considerably more sand. Areas are flat or very gently undulating. The soil occurs on terraces or benches and is everywhere above overflow. Drainage is good, as the slope down the valleys and toward the streams is sufficient to carry off all surplus moisture. The soil is nowhere subject to erosion.

Owing to its small extent, the soil is of little agricultural importance in Buffalo County. It is naturally strong and fertile, however, and ranks equally with Hall silt loam in productiveness. Practically all of it is under cultivation to corn, wheat, alfalfa, and oats. The yields are about the same as those on Hall silt loam, the land is managed in the same manner, and there is little or no difference in the sale price of the two soils.

HALL FINE SANDY LOAM

The topsoil of Hall fine sandy loam is very dark grayish-brown, loose, friable fine sandy loam from 8 to 12 inches deep. It is rich in organic matter and appears almost black when wet. The sand is largely of the fine and very fine grades and little material coarser than fine sand is present. The upper part of the subsoil, which continues to an average depth of 18 inches, is only slightly lighter in color than the layer above. It consists of loose, friable fine sandy loam containing a comparatively large percentage of fine and medium sand, together with scattered fine gravel. The lower part of the subsoil is ash-gray or almost white, smooth, powderlike silt or silty clay material which continues to a depth of more than 3 feet. The transition between the topsoil and the upper subsoil layers is gradual in texture, color, and structure, but that between the two subsoil layers is very abrupt. The soil is calcareous below an average depth of 22 inches, and the lower part of the subsoil and the substratum contain considerable lime. The upper subsoil layer is more open than is usual in members of the Hall series as mapped in Buffalo and adjoining counties. This condition is apparently the result of an unusually high proportion of sand in the upper part of the parent alluvial deposit from which the soil has weathered.

Hall fine sandy loam is very uniform throughout its occurrence in Buffalo County. There are a few minor variations in the depth, color, and texture of the topsoil and in the comparative thickness of the different soil layers, but these are of such local distribution and minor importance as not to warrant separation on the soil map.

Hall fine sandy loam occurs only in a few small areas on the Platte River terraces in the southern and southeastern parts of the county. The largest area, covering about 3 square miles, occurs as a narrow strip bordering the Platte River bottom lands south of Kearney. The total extent of the remaining areas is less than 2 square miles. A few of them occur along the Buffalo-Hall County line south of Shelton.

This soil has been derived in the same manner as the other members of the Hall series. Its higher content of sand is due in part to a deposition of coarser material and in part to sands blown from the surrounding areas. The surface is flat or very gently undulating, usually with a slight slope toward the stream and down the valley. Drainage is good. The surface lies from 10 to 15 feet above the normal flow of the river and is nowhere subject to inundation. The porous subsoil affords ample underdrainage.

Hall fine sandy loam is of little agricultural importance in Buffalo County, on account of its small extent. It is well adapted to all the common crops, however, and yields are as high as on any of the terrace soils. Practically all of it is under cultivation to corn, alfalfa, oats, and wheat. Yields depend on the rainfall, but under the same moisture conditions all crops produce as well as on Hall silt loam or Waukesha silt loam.

This soil is loose and mellow and is easily kept in good tilth. It is managed in the same way as are the heavier terrace soils, though it can be cultivated under a somewhat wider range of moisture conditions and with less power and lighter machinery on account of

the greater quantity of sand in its surface layer. It has about the same sale value as Hall silt loam.

CASS LOAMY FINE SAND

The topsoil of Cass loamy fine sand is dark grayish-brown, loose fine or medium sand, from 6 to 10 inches deep. It contains a large quantity of organic matter which gives it the dark color and loamy texture. The upper part of the subsoil is gray or light grayish-brown medium sand. The material becomes coarser with depth and grades to a light-gray, loose, incoherent mass of coarse sand and gravel as the depth approaches 3 feet. The subsoil is very deficient in organic matter, as the color indicates. In most areas the entire soil is low in lime.

A few minor variations are included in mapped areas of this soil. In places, the subsoil contains little or no gravel but consists of light-gray or almost white fine or medium sand which continues below a depth of 3 feet. In the more poorly drained areas, rust-brown mottles occur throughout the subsoil, and the material is slightly compact in places owing to an admixture of a small quantity of clay with the sand.

The most important variations in the topsoil approach either fine sandy loam or sand. The fine sandy loam occurs where conditions have been especially favorable for the growth and decay of plant life and the sand where, on account of being exposed, much of the organic matter has been removed by the wind. In a few places adjacent to stream channels, where the parent material has been deposited so recently that little organic matter has accumulated, the topsoil is nearly pure sand.

Cass loamy fine sand is the dominant bottom-land soil along South Loup River in the northern part of the county and occurs in many places along Platte River in the southern part. Most of the areas are narrow strips adjacent to the stream channels. Many of those along South Loup River extend for several miles, but along Platte River, most of the patches are small and scattered.

This soil has weathered from sandy alluvium carried down by the streams from adjacent uplands and from regions to the west and deposited on the present flood plains. Sand blown by the wind from the river channels during low stages of the streams has also undoubtedly contributed to the formation of the material. The subsequent growth and decay of plant life has been largely responsible for the dark color and loaminess of the topsoil.

Areas of this soil are flat, modified by numerous depressions, dry channels, and slight elevations. Drainage is in most places adequate. The surface, however, lies but a few feet above normal stream flow, and areas along South Loup River are subject to occasional inundation. Platte River seldom overflows its banks, but over large areas the water table along this stream lies too near the surface for profitable farming. In wet seasons the water table often rises, producing marshy conditions in many places. During extremely dry years, the underdrainage is excessive, and crops sometimes suffer from lack of moisture.

This is not an important agricultural soil, chiefly on account of its uncertain drainage. About 60 per cent of it is under cultivation, and the remainder is used chiefly for the production of hay. The soil supports a rank growth of prairie and water-loving grasses and sedges. Corn is the leading cultivated crop, followed in importance by alfalfa and oats. Truck crops, including tomatoes, onions, radishes, celery, cucumbers, parsley, watermelons, and cantaloupes, are grown rather intensively in the vicinity of the larger towns, as the soil warms up early in the spring and is well adapted to truck farming.

Wheat and oats do not do so well on this soil as on the heavier and better-drained soils of the county. During wet seasons there is excessive stalk growth at the expense of the grain, and the stems often lodge, making harvesting difficult. Alfalfa is not grown where the water table lies near the surface. Hog raising is important on those areas where alfalfa can be successfully grown. The grazing industry is not so important as on the soils of the Valentine series and on dunesand, because larger returns are realized from the production of native hay. A few cattle are fed for the Omaha market.

The average yield of corn is about 30 bushels to the acre during normal years. Oats yield from 20 to 30 bushels and alfalfa from 2 to 3 tons to the acre from three cuttings. Yields of truck crops are not available, as the industry is new and accurate records have not been kept. The native grasses on this soil will support a cow or horse on each acre, or when cut for hay they yield about 1 ton to the acre during average years. The hay is coarser and has a lower feeding value than that obtained on the terrace and upland soils of the county, but its larger yield tends in a measure to offset its poorer quality.

The current selling price of the land ranges from \$25 to \$100 an acre, depending on drainage, improvements, and location with respect to markets.

CASS FINE SANDY LOAM

Cass fine sandy loam has a topsoil of loose, friable, very dark grayish-brown fine sandy loam from 6 to 8 inches deep. It contains a comparatively large proportion of silt and very fine sand but little material coarser than medium sand. The soil is rich in organic matter. The subsoil is porous gray or light grayish-brown very fine sand or fine sand which grades, at a depth of about 16 inches, to a light-gray, loose, incoherent mass of coarse sand and gravel. This coarse material continues to a depth greater than 3 feet. The transition between the topsoil and subsoil is in most places very abrupt, both in color and texture. The subsoil is very deficient in organic matter. The soil has a few minor variations which are of such small extent and slight importance that they are not shown on the soil map. The subsoil variations are about the same as those occurring in Cass very fine sandy loam. In fact, the subsoils of all the sandy members of the Cass series, as mapped in Buffalo County, are very similar in most characteristics.

The principal variation of the topsoil is toward loamy sand, and small patches of Cass loamy sand are included with mapped areas of this soil.

Cass fine sandy loam occurs in numerous areas of various sizes throughout the Platte River flood plains in the southern part of the county. Some areas are along South Loup River in the northern part of the county. Most of the areas are narrow and elongated and extend roughly parallel to present and old river channels. This is the dominant bottom-land soil on the north side of Platte River between Kearney and Odessa. It is also extensive in the southeastern part of the county, both on the north side of Platte River and on the numerous islands between river channels. One of the largest areas in the South Loup River Valley is on both sides of the stream a few miles northwest of Sartoria. Other areas are along Muddy Creek west of Ravenna.

Cass fine sandy loam has developed from flood-plain material which was deposited by water during comparatively recent times. Subsequent weathering and the accumulation of organic matter have greatly modified the surface of the original deposit. Most areas are flat but are modified in places by slight elevations, old cut-offs, stream channels, and shallow depressions. Drainage conditions, as a whole, are about the same as on Cass loamy fine sand. Most of the soil is adequately drained, but there are small areas which are either subject to overflow or in which the water table is too near the surface for most crops.

About 60 per cent of this soil is under cultivation. The remainder, including the poorly drained areas, is used for pasture and hay land. This is not an important soil in this county on account of its rather small total extent. It is easily tilled, however, is very fertile, and good yields of corn, alfalfa, and truck crops are obtained where drainage is adequate. Alfalfa does fairly well. Small grain is not grown extensively, as the moist conditions favor excessive vegetative growth, and there is danger of lodging.

The poorly drained areas support a luxuriant growth of prairie and marsh grasses and are used chiefly for the grazing of beef cattle and the production of hay. Hogs are raised on all farms where corn is produced. The dairy industry is not important, but most farmers have a surplus of dairy products for sale. Most of the milk cows are of the beef breeds.

The average yield of corn is about 30 bushels to the acre. Alfalfa yields from 2 to 3 tons from three cuttings. The native grasses yield about 1 ton of hay to the acre during normal years or will support a cow or horse to the acre during the summer grazing season. Accurate crop reports are not available for the truck crops.

This land has about the same sale value as Cass loamy fine sand.

CASS VERY FINE SANDY LOAM

The topsoil of Cass very fine sandy loam is friable very fine sandy loam from 6 to 8 inches deep. The color ranges from grayish brown to dark grayish brown, and in a moist condition the soil appears almost black. There is an abrupt change to the subsoil, which consists of a light-brown incoherent mass of medium or coarse sand and fine gravel. This coarse material becomes gradually lighter in color with depth but remains very uniform in texture and structure. The substratum consists of light-gray sandy gravel. The

surface layer is rich in organic matter, but the coarse-textured subsoil layers are very deficient in it.

The soil includes a few variations which are not of sufficient importance to warrant separate mapping. In a few places, the subsoil is made up of alternate layers of silt, sand, and clay, the sand predominating. In places the subsoil, below a depth of 8 inches, consists of gray or almost white fine or medium sand, which may continue to a depth of 3 feet or may be underlain by a stratum of coarse sand and gravel. The principal textural variations approach fine sandy loam, and small patches of Cass fine sandy loam are included in mapped areas of this soil.

Cass very fine sandy loam has not a large total area in Buffalo County. It occurs chiefly in small, irregular areas and narrow strips throughout the Platte River flood plains. The largest areas are between the river channels in the extreme southeastern part of the county. A small patch lies between Turkey Creek and Platte River in the southwestern part. The soil occurs only locally along South Loup River.

This soil has been derived in the same manner as the other members of the Cass series. The finer texture of its topsoil results largely from variations in the character of stream sediments at the time of the deposition of the material. The surface is prevailingly flat, except where it is relieved by old stream channels, sloughs, and shallow depressions. The surface is, on the whole, slightly below that of Cass loamy fine sand and Cass fine sandy loam, and a larger percentage of the land is unsuited to crop production on account of the nearness of the water table to the surface. About 70 per cent of the soil is used as pasture and hay land, and the remainder is used largely for the production of corn and alfalfa. The native vegetation consists of a luxuriant growth of prairie and marsh grasses, with marginal strips of cottonwood and scrub willow along stream channels. The grazing of beef cattle and the production of native hay are the chief industries. Most of the cattle are native stock, chiefly Shorthorn. A few hogs are raised on farms where corn and alfalfa are produced.

Crop yields are about the same as those obtained on Cass fine sandy loam, and where drainage conditions are similar the soil has about the same sale value.

CASS LOAM

The topsoil of Cass loam is very dark grayish-brown or black coarse-textured loam from 6 to 8 inches deep. It is composed chiefly of silty clay and organic matter, together with a large proportion of fine sand and very fine sand. The upper part of the subsoil is light ash-gray very fine sand containing barely sufficient silt and clay to bind the particles loosely together when dry. The lower part of the subsoil, below a depth of about 18 inches, is a light-brown, loose, porous mass of coarse sand and gravel which continues to a depth greater than 3 feet below the surface. The transition in color and texture between the different soil layers is very abrupt. The topsoil and the upper subsoil layer in most places contain sufficient calcium carbonate to cause effervescence with acid, but most of the lime has been leached from the porous gravelly lower

subsoil layer. The organic matter, so abundant in the topsoil, rapidly decreases with depth and is lacking below a depth of 18 inches.

The soil, as mapped in this county, includes a few minor variations in the texture of the topsoil and in the comparative thickness of the different subsoil layers. None of these variations is sufficiently extensive or important to warrant separation on the soil map.

Cass loam is one of the least extensive soils in Buffalo County. Its total area does not exceed 800 acres. It occurs in only a few small areas on the Platte River flood plains in the southeastern part of the county. One of the largest and most typical areas is south of the Chicago, Burlington & Quincy Railroad, a few miles east of Kearney. A small, though rather uniform, patch is adjacent to one of the river channels southeast of Buda station. Small areas border the south channel of Platte River south of Shelton.

Areas of this soil are flat but locally are modified by shallow depressions and old stream channels. Drainage is variable. None of the soil is subject to overflow from the streams, but in many places the water table is too near the surface for profitable farming. Only about 50 per cent of the soil is under cultivation. The remainder is used for pasture land. Corn and alfalfa are the chief cultivated crops, and the yields are usually slightly higher than those obtained on the coarser soils of the Cass series. No sale value is available for this soil, as it constitutes a very small percentage of the farm land in Buffalo County.

CASS CLAY LOAM

The topsoil of Cass clay loam is dark grayish-brown or black clay loam from 6 to 8 inches deep. It contains considerable silt and very fine sand but little material of a coarser texture. It is rich in organic matter and appears black when wet; when dry it has a distinct grayish cast. The upper part of the subsoil, to an average depth of 18 inches, is black, plastic sandy clay which becomes hard and brittle on drying. The lower part of the subsoil is a porous mixture of gray fine or medium sand carrying sufficient clay to make it feel gritty and sticky when wet and to bind the sand particles together rather firmly when dry. The topsoil and upper subsoil layer merge gradually into one another, but there is generally a sharp change to the porous, sandy lower subsoil layer.

A few variations occur. In some areas the topsoil is very dark grayish-brown loam or sandy loam underlain, at a depth varying from 2 to 4 inches, by black, waxy clay or clay loam. In a few places the topsoil is dark-drab, sticky, plastic clay which becomes hard and compact and cracks during periods of drought. The percentage of lime varies considerably, but as a rule the surface soil is rather calcareous and in places the entire soil contains sufficient lime to react with acid. In a few places no lime reaction is obtained within a depth of 3 feet. Small alkali spots, varying in extent from a few square rods to about an acre, occur in places on the more poorly drained areas of the soil.

Cass clay loam occurs in only a few scattered areas throughout the Platte River flood plains in the southern part of the county. One of

the largest areas, comprising about 2 square miles, is south of Buda station, on the north side of Platte River. Smaller areas of typical soil are south of Platte River, in the extreme southeastern part of the county. A long, narrow strip borders Turkey Creek south of Odessa. The remaining patches are few and small.

The surface of Cass clay loam is flat, except where it is modified by stream channels and slight depressions. The soil occurs in the lowest positions of any of the Cass soils, so that it is poorly drained. The heavy topsoil prevents free underdrainage, and the water table is too near the surface for most crops.

Very little of this soil has been placed under cultivation on account of its small extent and poor drainage. It is valued chiefly for hay and pasture land. In dry years fair yields of corn are obtained by careful management on the better-drained areas. The topsoil cracks badly, however, owing to its high percentage of clay, and crop roots suffer severely from lack of moisture unless the land is frequently stirred to maintain a surface mulch. In most places this soil supports a heavier growth of native grasses than the lighter-textured members of the series.

Accurate sale values for Cass clay loam are not available on account of its small extent.

This soil should probably be used for hay and pasture, as it is doubtful if the net returns from grain crops would warrant draining the land.

O'NEILL LOAMY FINE SAND

The topsoil of O'Neill loamy fine sand is dark grayish-brown, loose, incoherent loamy fine sand from 8 to 10 inches deep. It is composed chiefly of gray fine or medium sand carrying sufficient organic matter to give the mass a loamy texture and dark color. There is seldom enough silt and clay present to prevent drifting when the native sod is destroyed and the soil is left unprotected. The subsoil material, to a depth greater than 3 feet, differs little in structure from that of the surface layer but contains less organic matter and is lighter in color and texture, being loose, gray, almost pure sand. Small, scattered pebbles are in most places present on the surface and throughout the soil, which is low in lime.

In a few places, wind action has retarded the accumulation of organic matter, and the surface soil is lighter in color than typical. Were such areas of sufficient size to warrant mapping, they would be classed with O'Neill fine sand, as was done in Hall and Howard Counties, Nebr.

O'Neill loamy fine sand occurs chiefly in a few scattered areas on the terraces of South Loup River in the northern part of the county. Most of the areas are small and of irregular shape, few exceeding 2 square miles and most of them ranging in size from 40 to 480 acres. Two of the largest areas lie on both sides of South Loup River in the extreme northeastern part of the county. A few patches are south and east of Pleasanton, on the south side of the river. The soil occurs in only a few places in the valley of Platte River.

This soil has weathered from sandy alluvial materials deposited by the streams when they were flowing at a higher level. In gen-

eral, areas are flat or gently undulating, though wind action has produced, in some places, numerous low, rounded knolls and ridges which give the surface a rather hummocky appearance. Drainage is good and in many places is excessive. There is practically no surface run-off, but the water sinks rapidly into the loose, porous sand, and the soil is not retentive of moisture.

O'Neill loamy fine sand is of little agricultural importance in Buffalo County, on account of its small extent, instability, and low water-retaining power. About 70 per cent of it is used in the production of corn and alfalfa. The remainder is used for hay and pasture land. The native vegetation includes a great variety of nutritious grasses, of which big bluestem, little bluestem, sand grass, stipa, and grama grass are the most common. The land is poorly suited to small grains, on account of its incoherence which favors soil drifting, with consequent injury to shallow-rooted crops.

Beef cattle are grazed on the uncultivated areas. Hereford is the principal breed. Hogs, chiefly of the Duroc-Jersey or Hampshire breeds, are raised on every farm.

The average yield of corn is about 15 bushels to the acre and of alfalfa is from $1\frac{1}{2}$ to $2\frac{1}{2}$ tons from three cuttings. Alfalfa makes a fair growth on this soil, but it is extremely difficult to obtain a good stand on account of the loose seed bed. The crop rarely lasts so long nor is it so thick as on the soils of the Hall series, owing to the lack of lime in this soil. The native grasses of each 3 acres will support one cow or horse during the summer grazing season, or when cut for hay the yield will be from one-fourth to one-third ton to the acre.

O'Neill loamy fine sand is easily managed. It does not require so much power nor such heavy machinery as the finer-textured terrace and upland soils. It can be cultivated under any moisture condition without injury, provided care is taken to prevent soil blowing. No commercial fertilizer is used. Available manure and straw are applied to the land, as they increase the fertility and tend to make the soil more stable.

The current value of this land ranges from \$30 to \$70 an acre, depending largely on improvements and location.

The chief need of this soil is protection against drifting when under cultivation. Alfalfa and sweet clover are excellent crops for this purpose. Corn should be deeply listed, with the furrows running at right angles to the prevailing northwesterly winds if possible. Heavy applications of barnyard manure and straw have proved beneficial. The land should not be left unprotected longer than is absolutely necessary.

O'NEILL VERY FINE SANDY LOAM

The topsoil of O'Neill very fine sandy loam is dark grayish-brown or almost black friable very fine sandy loam from 12 to 18 inches deep. It contains a large quantity of silt and organic matter and a small proportion of particles coarser than fine sand. The upper subsoil layer is grayish-brown sandy loam material. It is loose and friable in its natural condition but contains sufficient clay to bind the sand particles together rather firmly when air-dried. Below an average depth of about 25 inches, the quantity of clay decreases

rapidly, and the material is a loose, porous, and rather incoherent mass of medium or coarse sand and gravel. Neither the topsoil nor subsoil contains sufficient lime to react with dilute hydrochloric acid. The organic matter so abundant in the topsoil rapidly diminishes with depth and only slight traces occur below a depth of 24 inches. The soil differs from Waukesha very fine sandy loam in having a sandier and less coherent subsoil.

O'Neill very fine sandy loam occurs in a few scattered areas on the South Loup River terraces in the northern part of the county, and small areas are along Platte River in the southeastern part. Its total extent does not exceed 5 square miles. One of the largest and most typical areas is 2 miles southwest of Gibbon. A smaller, though rather uniform one lies southwest of Sartoria. Patches occur south of Saint Michael and South Ravenna in the northeastern part of the county.

This soil has been derived in the same manner and from the same material as O'Neill loamy fine sand. Undisturbed weathering, however, has evidently continued for a longer time as the surface soil has accumulated a larger proportion of organic matter and is considerably more stable.

Areas are flat or gently undulating, with a slight slope down the valleys and toward the stream channels. Drainage is everywhere good. The slight slope and loose porous subsoil afford ample surface and internal drainage. The soil is somewhat more retentive of moisture than O'Neill loamy fine sand, as it contains more organic matter.

About 90 per cent of this soil is under cultivation to corn, alfalfa, and small grains. The remainder is used for hay and pasture. Hogs are raised on every farm, but cattle raising is not practiced extensively as most of the land is better suited to crop production than to grazing. A few cattle are fed for eastern markets during the winter. The same grasses that thrive on O'Neill loamy fine sand grow on this soil, but the proportion of grama grass is larger and there is some buffalo grass.

Crop yields vary widely from year to year, depending on the rainfall. During normal years corn yields about 25 bushels to the acre, alfalfa between 2 and 3 tons, wheat 12 bushels, and oats about the same as corn.

This soil is managed in the same way as the heavier-textured Hall and Waukesha soils. It is somewhat easier to till, on account of its looser structure and heavier texture, and it can be cultivated under a wider range of moisture conditions. Barnyard manure and straw are the only fertilizers used.

The current value of O'Neill very fine sandy loam ranges from \$75 to \$100 an acre. The higher price applies to exceptionally well-improved land.

LAMOURE VERY FINE SANDY LOAM

The topsoil of Lamoure very fine sandy loam is very dark grayish-brown or black friable very fine sandy loam from 8 to 12 inches deep. It contains a large percentage of silt but only a little material coarser than fine sand. An abundance of organic matter gives the soil its dark color. The upper subsoil layer consists of moderately compact mottled gray and dark-gray sandy clay. It is plastic and gritty

when moist but becomes hard and brittle on drying. The material of the lower subsoil layer, which occurs at a depth of about 24 inches and continues to a depth of more than 3 feet, is lighter in color and more friable than the layer above, being light-gray or mottled light-gray and white very fine sandy loam containing a large proportion of silt and clay. In many places a layer of coarse sand and gravel occurs at a depth ranging from $3\frac{1}{2}$ to 5 feet. The topsoil is slightly calcareous, and the entire subsoil is rich in lime. Small angular lime concretions are abundant in the lower stratum. Alkali spots, from a few square rods to about one-half acre in size, occur here and there.

Included with mapped areas of this soil are a few small patches in which the surface soil is fine sandy loam. Two such patches occur along the Hall-Buffalo County line between Denman and Shelton. The total area of Lamoure fine sandy loam, however, is not sufficient to warrant its separation on the soil map of Buffalo County and for this reason it was included with Lamoure very fine sandy loam.

Lamoure very fine sandy loam is one of the less extensive soils in Buffalo County. It occurs only in small scattered areas and narrow strips in the Platte River flood plains throughout the southern part of the county. One of the largest areas, covering about 3 square miles, borders the southern edge of the terrace south of Gibbon. Several small patches are between the main and south channels of Platte River in the extreme southeastern part of the county. Typical areas are east of Kearney, on the north side of the canal, and a small patch lies near the mouth of Elm Creek in the southwestern part of the county.

This soil has developed from recently deposited alluvium which consists mostly of loessial material which has been deposited on the flood plains and low terraces along Platte River. The typically flat surface is modified in a few places by shallow depressions, old cut-offs, and stream channels. Drainage is poor. Very little of the soil is subject to overflow from the main stream channels, but the water table is so near the surface that the soil is too moist for most crops. The rather heavy subsoil layers prevent adequate underdrainage and in seasons of heavy rainfall water stands on the surface of the lower areas for a considerable time after rains.

Owing to its small extent and poor drainage, this soil is of little importance. Practically all of it is included in pasture and hay land. Some corn is grown on a few of the better-drained areas, but the yields are low except in the most favorable seasons. The native vegetation consists of a luxuriant growth of water-loving grasses and sedges, of which salt grass has the largest acreage. In a few places timothy and clover have been sown among the native grasses, greatly improving the hay and pasture.

Cattle raising is the chief industry practiced on this soil. Most of the animals are Hereford and Shorthorn. A few milk cows, chiefly of the beef breeds, are kept to supply the dairy needs. The native grasses will support one cow or steer to the acre during the summer grazing season, or when cut for hay yield from 1 to $1\frac{1}{4}$ tons to the acre.

Lamoure very fine sandy loam sells at prices ranging from \$50 to \$100 an acre, depending largely on location.

The chief need of this soil is artificial drainage. It is naturally strong and fertile and is easy to manage when adequate drainage is

established. A system of deep ditches or tiling would greatly increase the producing power of the land. Even under present drainage conditions the quality of the hay crop could be greatly improved by sowing more timothy and clover among the native grasses.

LAMOURE SILT LOAM

Lamoure silt loam has a topsoil of very dark grayish-brown or black heavy silt loam from 6 to 10 inches thick. It contains a large quantity of clay and considerable very fine sand, but little coarser material. The soil is rich in organic matter. The upper part of the subsoil is black, moderately compact clay or clay loam material, which is plastic and sticky when wet but which becomes hard and brittle on drying. This material is underlain, at a depth of about 20 inches, by more friable silty clay usually mottled gray and white. Porous medium or coarse sand and fine gravel occur at a depth ranging from $3\frac{1}{2}$ to 5 feet. The topsoil and upper subsoil materials are in many places slightly calcareous, and the lower subsoil layer is rich in lime, the carbonates existing both in finely divided form and as numerous angular concretions. Lamoure silt loam, as mapped in this county, includes some areas of very fine sandy loam and loam which can not be accurately differentiated on the map.

This soil occurs only in scattered areas throughout the Platte River flood plains. One of the largest areas of most uniform soil, covering about 3 square miles, is about $2\frac{1}{2}$ miles southeast of Gibbon in the southeastern part of the county. Another area of typical soil is about $3\frac{1}{2}$ miles southwest of this town. Small patches lie within or border the terrace soils southeast of Elm Creek, south of Odessa, and in the vicinity of Alfalfa Center.

The soil has developed from the weathering of alluvial and loessial materials which have been recently deposited on the flood plains of Platte River. Areas are prevailingly flat, except where they are relieved by stream channels, cut-offs, and depressions.

Drainage is poor. The soil is not subject to overflow from the main stream, but the water table lies too near the surface in most places for profitable farming. Most of the soil is used for pasture and hay land. It is naturally strong and fertile, and in a few places where artificial drainage has been established, corn and alfalfa yields are as high as on any soil in the county. The native vegetation includes a luxuriant growth of salt, prairie, and marsh grasses. The grazing of beef cattle and the production of hay are the chief industries. The native grasses will support one cow or steer to the acre during the summer grazing season, or when cut for hay will yield from 1 to $1\frac{1}{4}$ tons. Under artificial drainage, corn yields from 30 to 50 bushels and alfalfa from 3 to 4 tons to the acre.

This land sells for about the same price as Lamoure very fine sandy loam.

LAMOURE SILTY CLAY LOAM

The topsoil of Lamoure silty clay loam is very dark grayish-brown or black silty clay loam, about 8 inches deep. It commonly contains some very fine sand but little coarser materials. The soil is moderately compact in its natural condition. The high proportion of clay

makes it sticky and plastic when wet and hard and brittle when dry. The upper subsoil layer consists of dark-gray compact silty clay which in many places is faintly splotched and streaked with light gray. At a depth of about 24 inches there is an abrupt change to the lower subsoil layer which is gray, light-gray, or mottled gray and white friable silty clay continuous to a depth of more than 3 feet. This material contains a great deal of lime. Below a depth ranging from $3\frac{1}{2}$ to 4 feet, the substratum contains numerous lime concretions and considerable coarse sand and fine gravel. In a few areas the soil contains sufficient alkali to be injurious even to the native grass vegetation.

The total area of Lamoure silty clay loam does not exceed 4 square miles. The soil occurs only in scattered areas on the north side of Platte River, in the southwestern part of the county. The largest of these, comprising about 2 square miles, is west of Elm Creek. Small areas are southeast of Odessa and east of Alfalfa Center.

This soil has been derived in the same maner as the other members of the Lamoure series. The heavier topsoil is probably the result either of variations in the character of the sediment carried by the streams or of its greater distance from the stream channels at the time of its deposition. Areas are flat and drainage is poor.

The water table is too near the surface for most crops. Some alfalfa and corn are grown on the better-drained areas, but most of the soil has its native covering of grasses and is used for pasture and hay land. The soil is durable and productive and when adequately drained the yields of corn and alfalfa equal those obtained on the Hall and Waukesha soils. The soil is difficult to manage, however, on account of the large proportion of clay it contains. If plowed when wet the soil clods, and subsequent wetting and drying or freezing and thawing are necessary to restore granulation. It is almost impossible to plow the land when it is extremely dry.

VALENTINE SAND

Valentine sand consists of light grayish-brown or yellowish-brown loose sand which varies only a little in texture or color to a great depth. The 6 or 8 inch surface layer contains a small quantity of organic matter which gives it a slightly darker color than the remainder of the soil. The soil is composed mostly of fine sand and very fine sand with barely sufficient silt and clay to render the mass slightly coherent when wet. The soil differs from dunesand in having a smoother surface and greater stability. It drifts badly, however, when the native sod is destroyed and the surface is left unprotected. Neither the topsoil nor subsoil is noticeably calcareous.

Valentine sand occurs in areas of various size throughout the South Loup River Valley. One of the largest areas, covering about 13 square miles, includes most of the territory between Poole and Saint Michael on the south side of the river. This body is not uniform but includes other soils within its borders. Small but typical patches are on the south side of the river in the vicinity of Poole, and southwest of Ravenna. A long, narrow strip borders the northern edge of the central upland division in the extreme northwestern part of the county. The remaining areas are few and small.

The origin of the soil material is difficult to determine. The sand of which it is so largely composed has evidently been derived in part from the sand sheet underlying the loess and in part from blown sands of the South Loup River alluvial lands. The material, however, has been so reworked and reassorted by wind and water that it is not possible to make any definite statement with regard to its origin.

Areas of this soil vary from almost flat to hummocky, but the greater part of it is gently rolling. Even the flatter areas are in most places modified by scattered, low, rounded knolls and ridges. Some areas have a choppy or billowy appearance. Drainage is everywhere good and in many places is excessive. There is very little run-off, but the porous sands absorb and carry off the moisture very readily.

This soil is of but little value for crop production as it contains little organic matter, has low water-retaining power, and drifts when the native sod is destroyed. Only about 25 per cent of it is under cultivation. Corn is the leading crop. Small grain is seldom grown because of the looseness of the seed bed. Alfalfa does fairly well but the low percentage of lime limits the life of the plants to such an extent that the stand rarely remains profitable longer than three or four years. Yields of all crops are usually low, except in the most favorable seasons.

Most of this land remains with its original covering of grasses and is used for cattle grazing and hay production. The native vegetation consists of sand grass, stipa, big and little bluestem, and some grama grass. These grasses will support from 150 to 250 head of cattle to the square mile during the summer grazing season, or when cut for hay yield from one-fourth to one-half ton to the acre, depending on the rainfall. Most of the cattle are raised on the ranches and are either sold as feeders to local buyers or are shipped to Omaha when they are two or three years old. A few ranchers ship in cattle for summer grazing. Grade Hereford and Shorthorn are the principal breeds. Every rancher produces enough dairy products for home use, and many sell butter and cream to the local markets.

Valentine sand sells at prices ranging from \$20 to \$50 an acre, depending largely on improvements, surface configuration, and location.

It is doubtful if more of this land should be brought under cultivation. Farming appears to be detrimental to the soil, as it is extremely difficult to prevent drifting when the native sod is destroyed. Coarse manure and straw spread over the land have proved beneficial. It is advisable to keep a covering of vegetation on the land as much of the time as possible, and the soil should not be disturbed until planting time.

VALENTINE LOAMY SAND

The topsoil of Valentine loamy sand, to an average depth of 8 inches, is grayish-brown or light grayish-brown sand containing sufficient organic matter to give the mass a loamy texture and a grayish-brown or dark grayish-brown color. It differs from Valentine sand only in its larger humus content and darker color. In a few places, where conditions have especially favored the growth

and decay of plant life, the organic matter is so abundant that the surface material is very dark brown or almost black. The subsoil is light-brown or yellowish-brown, loose, incoherent sand which continues to a great depth. The sand of which the soil is so largely composed includes about equal proportions of the fine and medium grades and barely sufficient silt and clay to make it slightly sticky when wet. Neither topsoil nor subsoil is noticeably calcareous.

Valentine loamy sand occurs only in a few small, isolated areas within the South Loup River Valley in the northern part of the county. Its total area does not exceed 3 square miles. One of the largest patches lies north of Sweet Creek in Garfield Township. A smaller area is south of this stream in Cherry Creek Township, and a typical and uniform one is mapped north of Poole in Beaver Township. The remaining patches are few and small. The soil has been derived from the same materials as Valentine sand and has weathered in the same manner but evidently for a longer time.

The surface, which is flat or gently undulating, is broken by small ridges and knolls composed of almost pure sand. As a whole, this soil is somewhat below the general level of Valentine sand and has a slightly more even surface. Surface drainage is not established, but the rain water readily sinks into the porous sand, and there is practically no run-off.

This soil is of little agricultural importance in the county, on account of its small extent. It is, however, a much better soil than Valentine sand. About 65 per cent of it is under cultivation, and the remainder is used for hay and pasture land. The same grasses as occur on the sand are found on this soil, but the vegetation is commonly heavier and there is considerably more grama grass.

Corn and alfalfa are the chief cultivated crops. The corn is listed deeply to prevent soil drifting and to conserve moisture. The soil is not well adapted to alfalfa, because it is so low in lime that the life of the crop is greatly shortened. The yields of both corn and alfalfa, however, are somewhat higher than on Valentine sand, on account of the greater quantity of humus and the more favorable moisture conditions. The soil is very retentive of moisture, considering its loose sandy texture, and during very dry years crop yields compare favorably with those on the heavier-textured Holdrege and Colby soils. In normal years, however, the "hard-land" soils give much larger returns. The average yield of corn is about 15 bushels and of alfalfa between $1\frac{1}{2}$ and 2 tons to the acre.

The native grasses on this soil will support a cow or horse to every 3 acres during the summer grazing season or when cut for hay will yield about one-half ton to the acre.

No accurate sale values are available for this soil, on account of its small extent. It is usually sold in conjunction with the grazing land and has a tendency to increase the general value of the ranches on account of its farming possibilities.

Although this soil is slightly more stable than Valentine sand, it drifts badly when the protective covering of grasses is removed unless great care is taken to protect it at all times. Large quantities of barnyard manure and straw have proved beneficial. It is advisable not to disturb the soil until planting time, as it should not be left unprotected longer than is absolutely necessary.

SPARTA SAND

Sparta sand is gray or light grayish-brown, loose, incoherent sand to a depth of more than 3 feet. To a depth of 4 or 6 inches, the material is slightly darker than the remainder of the soil, owing to the accumulation of small quantities of organic matter. The sand of which this soil is so largely composed is of nearly all grades. The proportion of the different grades varies with the locality, but in most places a uniform texture prevails to a depth of 3 feet. The topsoils of the fine-textured areas are in many places somewhat darker than those of the coarser, due to a slightly higher organic-matter content. The color of the subsoil, however, is remarkably uniform, regardless of texture. The soil is very low in lime. Scattered gravel may be present below a depth of 24 inches, but this is not characteristic of the soil.

Sparta sand occurs in numerous irregular areas and narrow strips throughout the South Loup River Valley in the northern part of the county. Most of the areas are adjacent to the bottom lands or flood plains along the streams. The largest and one of the most typical developments borders the north side of the flood plains for several miles northwest from Sartoria. Smaller, though rather uniform, patches are east of Poole, east of Ravenna, and along Sweet Creek. Typical areas are along the south side of South Loup River, in the extreme northwestern part of the county. None of this soil is mapped in the Platte River Valley.

Sparta sand is largely composed of slightly weathered terrace or bench sands which were deposited in a former flood plain when the streams were flowing at higher levels. Wind-blown sands from the present stream channels and from the near-by sandy soils have also undoubtedly contributed to its formation.

Most areas of this soil are flat or gently undulating, though the surface relief is modified in many places by low, rounded sand hummocks and ridges which have resulted from wind action. Surface channels are not established, but the underdrainage is in most places excessive and the soil is more or less droughty, because of its looseness and porosity. Crops usually suffer from lack of moisture during prolonged dry weather.

Sparta sand is of little agricultural importance on account of its loose incoherent structure and droughtiness. The soil blows badly when brought under cultivation, unless care is taken to protect it at all times. Less than half of it is under cultivation, the greater part being used for hay and pasture land. The native vegetation consists of sand grass, stipa, bluestem, and some grama grass. Corn is the chief cultivated crop. Very little small grain is grown on account of the injury to the young plants during dry windy weather. Grade Hereford and Shorthorn cattle are grazed on the areas not under cultivation. Most of the cattle are native, though a few farmers ship in stock for summer grazing. Cattle feeding is seldom practiced, although a few farmers sometimes fatten a carload or two during the winter. Hogs are raised on nearly every farm.

The native grasses on this soil will support from 150 to 200 cattle a square mile during the summer grazing season, or when cut for hay will yield from 200 to 300 tons, depending on the rainfall. Corn

yields from 15 to 20 bushels to the acre, but during dry years the grain sometimes fails to mature.

The current value of this land ranges from \$15 to \$25 an acre.

It is doubtful if more of this soil should be brought under cultivation, unless it is to be very carefully managed. Careless cultivation soon depletes the naturally low supply of organic matter and allows the soil to blow badly. The plowing under of vegetation and of large applications of manure and straw, and the maintenance of a protective covering of vegetation as much of the year as possible are necessary if this soil is to be used profitably for crop production.

SARPY LOAMY VERY FINE SAND

The topsoil of Sarpy loamy very fine sand is gray or ash-colored very fine sand or fine sand from 6 to 8 inches deep. It contains barely sufficient silt, clay, and organic matter to make it loamy. The upper part of the subsoil differs little in color from the layer above, but is composed chiefly of fine or medium sand. The lower subsoil layer, between depths of about 24 inches and more than 3 feet, consists of coarse sand and gravel. All soil layers are low in organic matter and are porous and incoherent. The topsoil and upper subsoil layers are in most places faintly calcareous. The gravelly lower part of the subsoil in few areas contains sufficient lime to react with acid.

This soil occurs only in a few small areas on the Platte River bottom lands southeast and southwest of Kearney. Its total area is 640 acres. The soil has developed from older and finer-textured alluvial sandy materials than those which have given rise to Sarpy sand.

Drainage is variable. The soil is not subject to overflow, but the water table is seldom more than 4 feet below the surface and during wet seasons it rises sufficiently to injure crop roots. In very dry years, the underground moisture loss is excessive, owing to the looseness and porosity of the subsoil.

This soil is of little agricultural importance on account of its small extent and uncertain drainage. It is, however, somewhat more stable than Sarpy sand and about 40 per cent of it is under cultivation. Corn is the principal crop. Fair yields are obtained during seasons of normal precipitation, provided care is taken to prevent soil drifting. The uncultivated parts of the soil are used exclusively for pasture and hay.

Accurate land values are not available for this soil, as it is usually sold in connection with better farming land.

SARPY SAND

Sarpy sand consists of a layer, 6 or 8 inches deep, of gray or grayish-yellow, loose, incoherent sand underlain to a depth of more than 3 feet by material of similar color but usually of coarser texture. The sand of which the soil is so largely composed consists chiefly of the fine and medium grades, although an abundance of coarse sand and gravel is present in most places below a depth of 24 inches. The surface layer is slightly darker than the remainder of the soil, owing to the presence of organic matter. Neither the topsoil nor subsoil is noticeably calcareous. The soil differs from the coarser-textured

Cass soils chiefly in its lower content of organic matter and in the lighter color of its surface layer.

Sarpy sand occurs chiefly in a few narrow, broken strips bordering South Loup and Platte Rivers and in small, elongated islands within the channel of the latter stream. One of the largest areas borders the north side of Platte River, a few miles south and east of Kearney. Smaller, though fairly typical, patches lie along South Loup River between Pleasanton and Poole, in the northern part of the county.

This soil has weathered from recently deposited sandy alluvium carried down by the streams and deposited on their flood plains during periods of high water. It has not yet developed the dark surface layer so characteristic of the Cass soils, as sufficient time has not elapsed for the growth and decay of much organic matter. In places, the material greatly resembles riverwash, as mapped in this county. It is more stable than riverwash, however, is usually covered with grass or willows, and is not so greatly influenced by each slight rise of the streams. The soil represents a transitional stage of soil development between the coarser Cass soils and riverwash.

Areas of Sarpy sand are flat and modified in places by old cut-offs, shallow depressions, and slight elevations. The latter are caused by the wind, which in the more exposed situations whips the loose, incoherent sand into low, rounded knolls and ridges. The surface is from 4 to 6 feet above the normal flow of the streams. Areas along South Loup River are subjected to occasional inundation. Platte River seldom overflows its banks, but even along this stream the water table is everywhere near the surface, and it rises sufficiently in wet years to cover small areas in the lower depressions. In dry years the soil becomes excessively dry, and vegetation suffers from lack of moisture.

Sarpy sand is not used for crop production, on account of its low organic-matter content, incoherent structure, and uncertain drainage. In dry years the soil blows badly where the native grasses are destroyed. All of it is used for pasture land. The vegetation in many places is sparse, and the soil does not have a high value even for grazing.

No accurate sale value is available as this land usually constitutes only a small part of the farms on which it occurs. It has a tendency, however, to lower the general value of the land.

Sarpy sand, being droughty and incoherent, is better suited to grazing than to crop production. Its stability and grazing value could be greatly improved by the addition of tame grasses, such as alsike and other clovers in the depressed areas and of sand grasses on the more exposed areas.

SCOTT SILT LOAM

The topsoil of Scott silt loam, to a depth of 10 or 12 inches, is very dark grayish-brown heavy silt loam containing much organic matter. It appears almost black when wet but has a slightly grayish cast when dry. The subsoil is steel-gray or slate-colored, dense, and extremely compact clay, which continues to a depth greater than 3 feet. It contains numerous rust-brown stains and streaks and scattered black, hard, almost round concretionary forms from one-eighth to one-fourth inch in diameter. The soil is seldom notice-

ably calcareous to a depth of 5 or 6 feet. In many places a layer from 2 to 6 inches thick of ash-gray or almost white floury silt loam occupies the lower part of the topsoil. This light-colored layer is either practically structureless or is composed of minute, horizontal, platelike forms which overlap one another, giving the layer a laminated appearance.

This soil occurs only in a few shallow, basinlike depressions scattered throughout the flatter parts of the uplands and terraces. Patches seldom exceed 160 acres in extent, and most of them range in size from a few square rods to about 1 acre. Drainage is poor, and after heavy rains water may stand on the surface a few days or several weeks. These areas are locally known as "buffalo wallows."

On account of its small extent and poor drainage the soil has practically no agricultural importance. In most places it is too wet for successful cultivation and is used chiefly for pasture land. Some of the areas occur in cultivated fields but are regarded as waste land and are seldom tilled.

WABASH CLAY LOAM

Wabash clay loam is black, moderately compact clay loam to a depth of 8 or 10 inches. It contains much silt, but little material coarser than very fine sand. The subsoil is grayish-brown or dark grayish-brown, moderately compact silty clay which continues to a depth greater than 3 feet. In many places it contains numerous rust-brown stains caused by poor drainage. Both soil horizons are rich in organic matter but low in lime. They are sticky and plastic when wet, but become hard and tough on drying. In the topsoil numerous seams and cracks develop during dry weather, owing to the shrinkage of the clay. The subsoil differs from that of members of the Lamoure series chiefly in its darker color, lower percentage of lime, and higher proportion of organic matter.

Wabash clay loam is one of the least extensive soils in Buffalo County. It occurs exclusively in a narrow strip, in few places exceeding 30 rods in width, along the channel of Wood River throughout its course across Grant Township in the west-central part of the county.

Wabash clay loam has developed from alluvial silts and clays which were deposited by the stream during periods of high water. The surface is but a few feet above the channel and is subject to frequent overflow.

Owing to its small extent and uncertain drainage, all of this soil is included in pasture land. It does not have a high value even for grazing, as the frequent overflows, with their consequent deposits of silt and clay, prevent normal vegetable growth. A fairly dense mixed stand of elm, ash, cottonwood, and box elder borders the stream channel. None of these trees are of merchantable size, but are locally valuable for fuel and fence posts.

No sale value can be given for this soil as it constitutes but a small percentage of the farms on which it occurs.

DUNESAND

Dunesand is grayish-brown or yellowish-brown smooth, incoherent, fine or medium sand which continues to a depth of more than 3 feet

with little change in texture or structure. The material, to a depth of 8 or 10 inches, contains some organic matter but not enough to prevent drifting when the covering of grass is removed. Dunesand is unusually retentive of moisture, considering its loose texture. Neither the topsoil nor subsoil is calcareous.

This soil occurs in scattered areas of various sizes throughout the South Loup River Valley in the northern part of the county. Most of it borders the bottom lands along the south side of the stream. One of the largest areas occurs as a long, narrow strip between Nantasket and Saint Michael, in the northeastern part of the county. A small area of fairly typical soil is southwest of Ravenna, and another borders the terrace on the west side of Sand Creek in the north-central part of the county. The origin of dunesand is difficult to determine. It evidently is composed partly of wind-blown deposits from the sandy alluvial lands along South Loup River and partly from coarse material within or underlying the upland loess. The loose, incoherent sand, however, has been so whipped about and reassorted by the wind that no positive statement can be made as regards its origin.

Dunesand sells at prices ranging from \$20 to \$35 an acre, depending on improvements.

Dunesand, being loose and incoherent, is of no value for farming and practically all of it is used for pasture. The native vegetation includes many grasses, of which long-leaved reed grass, redfieldia, and stipa are the most common. These afford good pasturage during the spring and summer, but in winter they are killed by frost and can not be depended on. The soil is capable of maintaining from 50 to 60 head of cattle to the section during the summer.

RIVERWASH

Riverwash is a term applied to small sand islands, bars, and flats within and adjoining the channel of Platte River. The material differs from Sarpy sand in the almost total absence of organic matter and in less stability. It is not permanent and undergoes change with each slight rise of the stream. Even during normal flow, small areas are shifted about, added to, or destroyed by the varying currents. The material represents the first stages of soil formation, and with the gradual accumulation of organic matter will ultimately develop into Sarpy and Cass soils.

SUMMARY

Buffalo County is in south-central Nebraska on the north side of Platte River. It has an area of 955 square miles or 611,200 acres.

The county is in the loess region. About three-fifths of it is upland and the remainder is alluvial land or terraces and first-bottom lands. The upland areas range in surface relief from almost flat to extremely rough and hilly. The alluvial lands have flat or gently undulating surfaces.

The county has an average elevation of about 2,100 feet above sea level. The range in elevation is about 570 feet from the lowest to the highest points. The general slope is toward the east.

Drainage is effected through the Platte and South Loup Rivers and their tributaries. As a whole, the land is well drained.

The county was established in 1855, the first settlement was made in 1858, and the county was organized in 1870.

According to the 1920 census, the population is 23,787, of which 32.4 per cent is classed as urban. Kearney, the county seat, has 7,702 inhabitants.

The county has good transportation facilities. It is crossed by several railroads, and public highways follow most section lines.

Omaha is the principal market for surplus wheat, corn, and live-stock.

The climate is well suited to grain farming and stock raising.

At present agriculture in the county consists of diversified farming, including the production of grain and hay and the raising of live-stock. Corn, wheat, wild hay, alfalfa, oats, coarse forage, barley, and rye are the principal crops, ranking in acreage in the order named.

The type of farming practiced is uniform, except that the comparative importance of the various crops differs with the sections. A rather large proportion of the bottom lands and the more sandy and rougher parts of the uplands are used for grazing. More of the better-drained terrace land is used for alfalfa on account of the favorable moisture supply and high yield.

The products of the livestock industry constitute an important source of farm income. This industry consists chiefly of the grazing and winter fattening of beef cattle and of the raising of hogs.

The Federal census reports the total value in 1919 of all crops in the county to be \$11,077,544 and of domestic animals to be \$5,598,147.

The average size of the farms in 1920 was 240.3 acres, of which 75.9 per cent is improved. The size usually ranges between 100 and 320 acres.

About 49 per cent of the farms are operated by the owners and the remainder by tenants or managers. The share system of land rental prevails.

The selling price of land ranges from \$20 to \$200 an acre, depending on the soil, lay of the land, drainage, improvements, and location with respect to markets.

Buffalo County lies in that part of the Great Plains where the rainfall is moderate and where the mature soils have not yet been leached of their carbonates to a depth greater than 3 feet. All the mature soils, therefore, show the influence of the prairie grasses and of weathering under the prevailing climatic conditions. The most striking characteristic and one which is common to all the mature soils is the dark color of the surface layers. This color results from the incorporation of carbonaceous material from the decayed grass vegetation. The second characteristic common to the mature soils is the arrangement and character of the soil layers. There is a thin, usually structureless surface mulch composed largely of fine mineral particles and organic matter in various stages of decay. This is underlain by a zone of imperfectly granular and slightly heavier material. Below this occur a slightly compact layer and a zone of lime concentration before the parent loess is reached. The several layers differ more or less in color, but the material becomes gradually lighter with depth.

The immature soils have developed under conditions which have retarded plant growth and decay. They are, therefore, light in

color. They occur only on the steeper valley slopes, as areas of loose, incoherent sand and as the most recent alluvial deposits.

Twelve soil series, including 27 soil types, and dunesand and riverwash have been mapped. The upland soils are grouped in the Holdredge, Colby, Valentine, and Scott series; the terrace soils in the Waukesha, Hall, O'Neill, and Sparta series; and the bottomland soils in the Cass, Lamoure, Wabash, and Sarpy series.



[PUBLIC RESOLUTION No. 9]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture"

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]

WESTERN NEBRASKA

[illegible]

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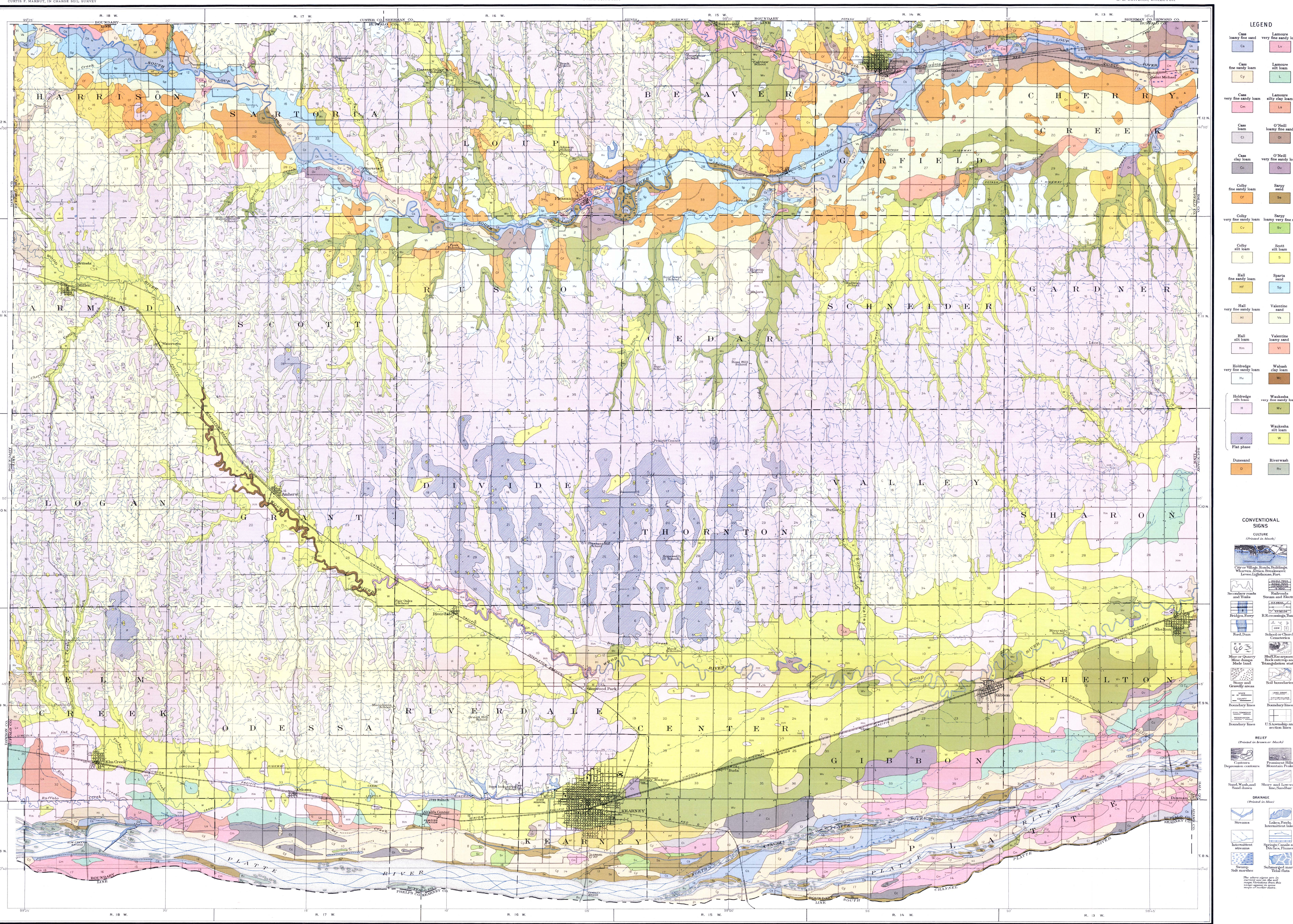
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- (2) fax: (202) 690-7442; or
- (3) email: program.intake@usda.gov.

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LEGEND

Cass loamy fine sand	Lamoure very fine sandy loam
Cs	Lv
Cass fine sandy loam	Lamoure silt loam
Cy	L
Cass very fine loam	Lamoure silty clay loam
Cm	Ls
Cass loam	O'Neill loamy fine sand
Cl	Ol
Cass clay loam	O'Neill fine sandy loam
Cc	Ov
Colby fine sandy loam	Sarpy sand
Cf	Se
Colby very fine sandy loam	Sarpy loamy very fine sand
Cv	Sv
Colby silt loam	Scott silt loam
C	S
Hall fine sandy loam	Sparta sand
Hf	Sp
Hall very fine sandy loam	Valentine sand
Hv	Vs
Hall silt loam	Valentine loamy sand
Hm	Vi
Holdrege very fine sandy loam	Wabash clay loam
Hv	Wc
Holdrege silt loam	Wabasha very fine sandy loam
H	Wv
Flat phase	Wabasha silt loam
	W
Dunesand	Riverwash
D	Rv

CONVENTIONAL SIGNS

(Printed in black)

City or Village, Roads, Buildings, Wharves, Jetties, Docks, Levees, Lighthouses, Fort	Steam and Electric
Secondary Roads and Trails	R. Recreations, Tunnel
Railroads	School or Church
Bridges, Ferry	Cemeteries
Port, Dam	
Mine or Quarry	Hot/Escarpment
Mine Jumps	Rock outcrop and
Made land	Transposition station
Soil boundaries	Soil boundaries
Boundary lines	Boundary lines
Boundary lines	US boundary and
Boundary lines	section lines

(Printed in brown or black)

Contours	Prominent Hills
Depression contours	Mountains, Peaks
Sand, Wash, and Sand dunes	Shore and Lowwater
	Line, Sandbar

(Printed in blue)

Streams	Lakes, Ponds, Intermittent lakes
Intermittent streams	Springs, Canals and
Swamp, Salt marshes	Ditches, Flumes
	Submerged marsh
	Tidal flats

The above signs are to be used in accordance with the symbols under signs in case of conflict.